No. 7284

United States Circuit Court of Appeals

For the Ninth Circuit.

THE MAGNAVOX COMPANY, a Corporation,
Appellant,

vs.

ERNEST INGOLD, INC., a Corporation,
Appellee.

THE MAGNAVOX COMPANY, a corporation,
Appellant,

vs.

STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a Corporation, and GARNETT YOUNG & CO., a Corporation,
Appellee.

Transcript of Record

Upon Appeals from the District Court of the United States for the Northern District of California, Southern Division.

Parker Printing Company, 545 Sansome Street, San Francisco.

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[Clerk's Note: When deemed likely to be of an important nature, errors or doubtful matters appearing in the original certified record are printed literally in italic; and, likewise, cancelled matter appearing in the original certified record is printed and cancelled herein accordingly. When possible, an omission from the text is indicated by printing in italic the two words between which the omission seems to occur.]

No. 2615-S

The Magnavox Company,
Appellant & Plaintiff

vs.

Ernest Ingold, Inc.,
Appellee & Defendant

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No. 2616-S

The Magnavox Company,
Appellant & Plaintiff

vs.

Stromberg Carlson Tel. Mfg. Co.,
Appellee & Defendant

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NAMES AND ADDRESSES OF ATTORNEYS:

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San Francisco, Calif.,
Attorneys for Appellee-Defendant.

United States District Court, Northern District of California, Southern Division.

In Equity
Number 2615 S

THE MAGNAVOX COMPANY, a corporation,
Plaintiff,

vs.

ATWATER KENT MANUFACTURING COMPANY, a corporation; and ERNEST INGOLD, INC., a corporation,
Defendants.

Patent Infringement:
Patent 1,266,988, Patent 1,448,279, Patent 1,579,392.

BILL OF COMPLAINT.

Comes now THE MAGNAVOX COMPANY, plaintiff above named, and complains of ATWATER

KENT MANUFACTURING COMPANY, a corporation, and ERNEST INGOLD, INC., a corporation, above-named defendants, and for cause of action alleges:

I.

That the plaintiff, THE MAGNAVOX COMPANY, during all the times hereinafter mentioned was and is a corporation duly organized and existing under and by virtue of the laws of the State of Arizona, with a place of business in the City of Oakland, County of Alameda, State of California.

II.

That the defendant ATWATER KENT MANUFACTURING COMPANY is a corporation organized under the laws of the State of Pennsylvania, with a regular and established place of business in the City and County of San Francisco, State of California; that the defendant ERNEST INGOLD, INC., is a California corporation with a place of business in the City and County of San Francisco, State of California. [1*]

*Page numbering appearing at the foot of page of original certified Transcript of Record.

III.

That the jurisdiction of the Court depends upon the Patent Laws of the United States.

IV.

That prior to the 3rd day of July, 1916, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful

improvements in Amplifying Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter-recited application for Letters Patent therefor, and not in public use or on sale in this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements, under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on the 3rd day of the July, 1916, file in the Patent Office of the United States a joint application for Letters Patent on said invention; that said application was duly assigned to Commercial Wireless & Development Company, a corporation organized under the laws of the State of Arizona, before the issuance of said Letters Patent, by assignment duly recorded in the Patent Office of the United States. That thereafter, to-wit, on May 21, 1918, all requirements of the statutes then in force having been complied with, Letters Patent of the United States for said invention, signed, sealed, and executed in due form of law, were duly issued to the said [2] Commercial Wireless & Development

Company as assignee of the entire right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,266,988, and said Letters Patent or a duly certified copy thereof are ready to be produced as this Court shall direct.

V.

That the Plaintiff, The Magnavox Company, by written assignment is now the sole and exclusive owner of the entire right, title, and interest in and to the aforesaid Letters Patent 1,266,988, including all rights to recover for past infringement thereof.

VI.

That prior to the 28th day of April, 1920, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful improvements in Electrodynamic Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter-recited application for Letters Patent therefor, and not in public use or on sale in this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements,

under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on the 28th day of April, 1920, file in the Patent Office of the United States a joint application for Letters Patent on said invention; that said application was [3] duly assigned to Plaintiff, The Magnavox Company, before the issuance of said Letters Patent, by an assignment duly recorded in the Patent Office; that thereafter, to-wit, on the 13th day of March, 1923, all requirements of the statutes then in force having been complied with, Letters Patent of the United States for said invention, signed, sealed, and executed in due form of law, were duly issued to the said The Magnavox Company, as assignee of the entire right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,448,279, and said Letters Patent or a duly certified copy thereof, are ready to be produced as this Court shall direct.

VII.

That prior to the 20th day of March, 1922, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful improvements in Electrodynamic Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter-recited application for Letters Patent therefor, and not in public use or on sale in

this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements, under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on the 20th day of March, 1922, file in the Patent Office of the United States a joint application for Letters Patent on said invention; that said application was [4] duly assigned to Plaintiff, The Magnavox Company, before the issuance of said Letters Patent by an assignment duly recorded in the Patent Office; that thereafter, to-wit on the 6th day of April, 1926, all requirements of the statutes then in force having been complied with, Letters Patent of the United States for said invention, signed, sealed and executed in due form of law, were duly issued to the said The Magnavox Company, as assignee of the entire right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,579,392, and said Letters Patent or a duly certified copy thereof, are ready to be produced as this Court shall direct.

VIII.

That Plaintiff is still the owner of all right, title, and interest in and to the aforesaid inventions, and in and to the aforesaid Letters Patents.

IX.

That the inventions of the several Letters Patents aforesaid are capable of conjoint use, and have been so used by Defendants herein.

X.

That the said inventions patented as aforesaid are of great value and utility to Plaintiff, and to the public generally; that the Plaintiff and its licensees, since the dates of said inventions, have caused to be manufactured and sold great numbers of said devices embodying the inventions of said Letters Patent and each of them; that Plaintiff has expended large sums of money in causing the said inventions to be developed, and has built up a large and profitable business for the exploitation of said devices, so that the said inventions and patent rights have been and are of great utility and great value to the Plaintiff and its licensees, and, but for the unlawful acts of the Defendants herein complained of, would have been of greater value and profit to them. [5]

XI.

That the devices caused to be manufactured and sold by Plaintiff and its licensees, embodying the inventions of the aforesaid Letters Patent, and each of them, have been and are duly marked "Patented," with the date and/or number of each of said Letters Patents, all in the manner prescribed by the Statutes of the United States; and Plaintiff's ownership of said inventions and Letters Patents has been widely

recognized and acquiesced in by the public and by the trade generally.

XII.

Plaintiff further shows that on the 16th day of August, 1928, it filed a suit in equity in the District Court of the United States for the Northern District of California, Southern Division, against Frederick H. Thompson Company, defendant, for the infringement of the said Letters Patents here in suit, being suit in Equity No. 2166-S; that the pleadings in the said cause were in the usual form; that the said Letters Patents were assailed for want of invention and novelty and that the said Edwin S. Pridham and Peter L. Jensen were not the original and first inventors and discoverers of the subject matter of the said Letters Patents or of any material or substantial part thereof, and that the same or material or substantial parts thereof had been in public use and on sale in this country prior to said invention and for more than two years prior to the respective applications for said Letters Patents, and that the same had been described and illustrated in printed publications prior to the dates of said inventions of said Edwin S. Pridham and Peter L. Jensen; that after a trial before said Court and the examination of witnesses and the introduction of documentary evidence by the respective parties and the evidence being closed and [6] argued by the respective parties the cause was submitted to the Court; and after due consideration said Court on the 9th day of April, 1930, sustained said patents and each of them and

adjudged the same to be valid in all respects, holding that said patents and each of them represented a new, useful, and patentable invention, and that the same was infringed.

XIII.

That, well knowing the premises, and with intent to injure and defraud the plaintiff, the defendants have jointly and severally and since the grant of said Letters Patents and each of them, and within six years prior to the filing of this Bill of Complaint, and within the Northern District of California, and elsewhere within the United States, infringed upon said Letters Patents and each of them, by making and/or selling and/or using devices embodying the inventions of each of said Letters Patents, which said devices infringed and infringe upon said Letters Patents and each of them and each and all of the claims thereof, by making and/or selling devices embodying the inventions of each of said Letters Patents and of the several claims thereof, all without the license or consent of plaintiff and in defiance of plaintiff's rights, and threaten to continue to so infringe, all to the great and irreparable damage of the plaintiff and to the unlawful gain and profit of the defendants.

WHEREFORE, plaintiff prays a decree of this Court against the defendants and each of them, as follows:

First. That upon the filing of this Bill of Complaint a preliminary injunction be granted, enjoin-

ing and restraining the defendants, and each of them, their respective agents, servants, attorneys, and employees, pendente lite, from making, using or selling any apparatus which infringes upon said Letters Patents, in violation of plaintiff's rights aforesaid. [7]

Second. That upon the final hearing defendants, and each of them, their respective servants, agents, attorneys, and employees, be permanently and finally enjoined and restrained from making, using or selling any device, machine or apparatus which infringes upon said Letters Patents Numbers 1,266,988, 1,448,279, and1,579,392, in violation of plaintiff's rights as aforesaid, and that a writ of injunction be issued out of and under the seal of this Court enjoining the said defendants and each of them, their respective agents, servants, attorneys and employees, as aforesaid.

Third. That plaintiff have and recover from the defendants the profits realized by the defendants, respectively, and the damages sustained by the plaintiff from and by reason of the infringement aforesaid, together with costs of suit, and that the said damages be trebled by reason of the willful nature of the infringement by defendants herein, and that plaintiff have such other and further relief as to the Court may seem proper and in accordance with equity and good conscience.

CHAS. E. TOWNSEND
WM. A. LOFTUS
THOS. G. GOULDEN
Attorneys for Plaintiff. [8]

State of California,
City and County of San Francisco.—ss.

On this 15th day of April, 1930, before me personally appeared EDWIN S. PRIDHAM, who, being by me duly sworn, deposes and says that he is Vice-President of THE MAGNAVOX COMPANY, the Plaintiff herein; that he has read the foregoing Bill of Complaint, and that the statements therein contained are true, of his own knowledge, except so far as they are alleged to be stated on information and belief, as to which statements deponent believes them to be true.

EDWIN S. PRIDHAM

Sworn to and subscribed before me this 15th day of April, 1930.

[Notarial Seal] W. W. HEALEY
Notary Public, in and for the City and County of San Francisco, State of California.

My Commission expires August 29, 1933.

[Endorsed]: Filed Apr 16 1930. [9]

[Title of Court.]

AT A STATED TERM of the Southern Division of the United States District Court for the Northern District of California, held at the Court Room thereof, in the City and County of San Francisco, on Monday, the 19th day of May, in the year of our Lord one thousand nine hundred and thirty.

PRESENT: the Honorable Frank H. Norcross sitting for St. Sure, J:

No. 2615

[Title of Cause.]

By consent, it is Ordered that the motion to quash Service be and the same is hereby granted. [10]

[Title of Court and Cause No. 2615-S.]

ANSWER OF ERNEST INGOLD, INC., TO THE BILL OF COMPLAINT.

Now comes Ernest Ingold, Inc., defendant in the above entitled suit, and for answer to the plaintiff's bill of complaint says:

1.

Answering the allegations of paragraph I of said bill, this defendant says that he is without knowledge of the said allegations or any of them.

2.

Answering the allegations of paragraph II of said bill, this defendant admits that the Atwater

Kent Manufacturing Company was and is a corporation organized under the laws of the State of Pennsylvania, but denies that it has or ever had a regular and established or other place of business in the City and County of San Francisco, or elsewhere in the State of California; and on this behalf defendant avers that by an order heretofore made and entered by this Court the suit was dismissed as to said Atwater Kent Manufacturing Company, and that company is no longer a party defendant in [11] the case; admits that the defendant Ernest Ingold, Inc., was and is a corporation with a place of business in the City and County of San Francisco, State of California.

3.

Answering the allegations of paragraph III of said bill, this defendant admits the same.

4.

Answering the allegations of paragraph IV of said bill, this defendant denies on information and belief that prior to the 3rd day of July, 1916, or at any other time, Edwin S. Pridham and Peter L. Jensen were the true or original or first or joint or any inventors of the alleged new and useful improvements in Amplifying Receivers referred to in said paragraph IV of said bill, not known or used by others in this country before their alleged invention or discovery thereof or patented or described in any printed publication in this or any foreign country before their alleged invention or discovery thereof, or more than two years prior

to their application for Letters Patent therefor referred to in said paragraph IV of said bill, or in public use or on sale in this country for more than two years prior to their said application, or that no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, or that the same had not been abandoned, or that the said Edwin S. Pridham and Peter L. Jensen were entitled to a patent for said alleged improvements under the provisions of the Statutes of the United States then in force, or that said Edwin S. Pridham and Peter L. Jensen did, on the 3rd day of July, 1916, or any other time, file in the Patent Office of the United States, a joint or other application for Letters Patent on said invention, or that the said applica- [12] tion was duly or otherwise assigned to Commercial Wireless & Development Company, a corporation organized under the laws of the State of Arizona, before the issuance of said Letters Patent, by an assignment duly or otherwise recorded in the Patent Office of the United States, or that thereafter, to-wit, on May 21, 1918, all or any requirements of the statutes then in force were complied with, or that Letters Patent of the United States for said invention, signed, sealed, or executed in due or other form of law, were duly or otherwise issued to the said Commercial Wireless & Development Company as assignee of the entire right, title and interest therein and thereto, or that the said Letters Patent

so alleged to have been issued were numbered 1,266,988, and as to whether or not said alleged Letters Patent or a duly certified copy thereof are ready to be produced as this Court shall direct, this defendant is without knowledge.

5.

Answering the allegations of paragraph V of said bill, this defendant says that he is without knowledge.

6.

Answering the allegations of paragraph VI of said bill, this defendant denies on information and belief that prior to the 28th day of April, 1920, Edwin S. Pridham and Peter L. Jensen were the true or original or first or joint inventors of the alleged new and useful improvements in Electrodynamic Receivers referred to in said paragraph VI of said bill, not known or used by others in this country before their alleged invention or discovery thereof, or not patented or described in any printed publication in this or any foreign country before their alleged invention or discovery thereof, or more than two years prior to their application for Letters Patent therefor referred to in said [13] paragraph VI of said bill, or not in public use or on sale in this country for more than two years prior to their said alleged application, or that no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the alleged application in this country, or that

same had not been abandoned, or that the said Edwin S. Pridham and Peter L. Jensen were entitled to a patent for said improvements under the provisions of the Statutes of the United States then in force, or that on the 28th day of April, 1920, or at any other time, they filed in the Patent Office of the United States a joint application for Letters Patent on said invention, or that said application was duly or otherwise assigned to plaintiff, The Magnavox Company, before the issuance of said alleged Letters Patent, by an assignment duly or otherwise recorded in the Patent Office, or that thereafter, to-wit, on the 13th day of March, 1923, all or any requirements of the statutes then in force had been complied with, or that Letters Patent of the United States for said invention, signed, sealed, or executed in due or other form of law, were duly or otherwise issued to the said The Magnavox Company, as assignee of the entire right, title and interest therein and thereto, or that said alleged Letters Patent, so alleged to have been issued as aforesaid, were numbered 1,448,279; and as to the allegation that said Letters Patent or a duly certified copy thereof, are ready to be produced as this Court shall direct, this defendant is without knowledge.

7.

Answering the allegations of paragraph VII of said bill, this defendant denies on information and belief that prior to the 20th day of March, 1922, or any other day, Edwin S. Pridham and Peter L. Jensen were the true or original or [14] first or

joint inventors of the alleged new and useful improvements in Electrodynamic Receivers, not known or used by others in this country before their alleged invention or discovery thereof, or not patented or described in any printed publication in this or any foreign country before their alleged invention or discovery thereof, or more than two years prior to their application for Letters Patent referred to in said paragraph VII of said bill, or not in public use or on sale in this country for more than two years prior to their said application, or that no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the alleged application in this country, or that the same had not been abandoned, or that the said Edwin S. Pridham and Peter L. Jensen were entitled to a patent for said alleged improvements under the provisions of the Statutes of the United States then in force, or that they did on the 20th day of March, 1922, or any other day, file in the Patent Office of the United States a joint or other application for Letters Patent on said alleged invention, or that said application was duly assigned to plaintiff The Magnavox Company before the issuance of said Letters Patent, by an assignment duly or otherwise recorded in the Patent Office, or that thereafter, to-wit, on the 6th day of April, 1926, or any other day, all or any requirements of the statutes then in force had been complied with, or that Letters Patent of the United

States for said invention, signed, sealed, or executed in due or any form of law, were duly or otherwise issued to the said The Magnavox Company as assignee of the entire right, title and interest therein and thereto, or that said Letters Patent so alleged to have been issued were numbered 1,579,392; and as to the allegation that said Letters Patent or a duly certified copy thereof are ready to be produced [15] as this Court shall direct, this defendant is without knowledge.

8.

Answering the allegations of paragraph VIII of said bill, this defendant is without knowledge.

9.

Answering the allegations of paragraph IX of said bill, this defendant denies on information and belief that the alleged inventions of the several Letters Patent aforesaid are capable of conjoint use, and denies that they have been so used by this defendant.

10.

Answering the allegations of paragraph X of said bill, this defendant denies on information and belief that the said inventions, alleged to be patented as aforesaid, are of great or any value or utility to the plaintiff or to the public generally, or that the plaintiff and its licensees or either of them, since the dates of said alleged inventions, have caused to be manufactured or sold great or any numbers of said devices embodied in the al-

leged inventions, or any of them, of said Letters Patent or of each or any of them, or that the plaintiff has expended large sums of money in causing the said alleged inventions to be developed, or has built up a large or profitable or any business for the exploitation of said devices, or that the said alleged inventions and patent rights have been or are of great or any utility or great or any value to the plaintiff or its licensees or any of them, or that but for the alleged unlawful acts of the defendants, complained of in the said bill, would have been of greater value or profit to the plaintiff or its licensees.

11.

Answering the allegation of paragraph XI of said bill, this defendant is without knowledge. [16]

12.

Answering the allegations of paragraph XII of said bill, this defendant is without knowledge.

13.

Answering the allegations of paragraph XIII of said bill, this defendant denies that it, well or otherwise knowing the premises referred to in said paragraph XIII of said bill, or with intent to injure or defraud the plaintiff or otherwise or at all, either jointly with others or severally by itself, since the granting of said alleged Letters Patent or either of them, or within six years prior to the filing of the said bill of complaint, or any other time, or within the Northern District of California or elsewhere in the United States, or anywhere,

has infringed upon said Letters Patent or either or any of them, by making or selling or using devices or any device embodying the alleged inventions of each or either or any of said Letters Patent which infringed or infringes upon said Letters Patent or each or either or any of them or any of the claims thereof, or by making or selling devices embodying the alleged inventions or any of them of each or either or any of said Letters Patent or of the several or any claims thereof, without the license or consent of plaintiff, or in defiance of plaintiff's alleged rights, or threatens to continue to so infringe, or that any such act or acts will be to the great or irreparable or any damage of the plaintiff or to the unlawful or any gain or profit of this defendant. And in this behalf this defendant denies that it has ever at any time or place made, used, or sold any device or devices containing or embodying the alleged inventions or any of them of said Letters Patent or either or any of them, or that it has infringed upon said Letters Patent or either or any of them or upon the claims or either or any of them of the said Letters Patent or either or any of them [17]

14.

And for a further and separate defense, this defendant pleads, and hereby gives notice that he will prove at the trial, that Edwin S. Pridham and Peter L. Jensen were not the original or first or joint inventors or discoverers of the alleged inven-

tions or any of them or any material or substantial part thereof sought to be patented in and by the several Letters Patent in suit, or either or any of them, but that prior to the alleged invention thereof by said Edwin S. Pridham and Peter L. Jensen, the things sought to be patented in and by the said Letters Patent, and each of them, had been described in certain printed publications and had been patented in and by certain Letters Patent of the United States and foreign countries to the following named persons on the following named dates and bearing the following numbers:

LETTERS PATENT OF THE UNITED STATES

Name of Patentee	Date of Issuance	Number of Patent
Edison	April 30, 1878	203,015
Edison	Nov. 25, 1879	221,957
Milliken	Aug. 15, 1882	262,811
Richards	June 12, 1894	521,220
Shreeve	April 12, 1898	602,174
Rose	Dec. 14, 1886	354,241
Burns	April 25, 1899	623,702
Dean	April 3, 1906	817,140
Kaisling	Nov. 10, 1908	903,197
Vreeland	Aug. 10, 1909	930,508
Vreeland	Oct. 12, 1909	936,684
Vreeland	Sept. 11, 1917	1,239,852
Rogers	April 22, 1884	297,168
Pridham	Jan. 21, 1913	1,051,113

[18]

LETTERS PATENT OF THE UNITED STATES (Continued)

Name of Patentee	Date of Issuance	Number of Patent
Field	June 11, 1895	540,969
Bain	Dec. 12, 1882	268,980
Siemens	April 14, 1874	149,797
Cuttriss et al	June 14, 1881	242,816
Lindsey	Oct. 27, 1908	901,974
Pearson	Nov. 10, 1908	903,745
Pollak	Nov. 9, 1909	939,625
Oliver	Mar. 8, 1910	951,695
Johnson	Oct. 14, 1913	1,075,786
Blanchard et al	July 21, 1914	1,104,610
Evershed et al	Mar. 9, 1920	1,333,298
King	Apr. 26, 1921	1,375,707
Cuttriss	Apr. 18, 1882	256,795
Jensen et al	Feb. 24, 1914	1,088,283
Weston	Jan. 13, 1891	444,805
Weston	Aug. 16, 1892	480,889
Willis	Apr. 25, 1916	1,180,462

LETTERS PATENT OF FOREIGN COUNTRIES

Name of Patentee	Country Where Issued	Number of Date
Edison	British	2,909 of 1877
Siemens	British	4,685 of 1877
Lodge	British	9,712 of 1898
Pollak	Norwegian	19,549 of 1909

Name of Patentee	Country Where Issued	Number of Date
Pollak	British	19,282 of 1907
Johnsen	British	12,141 of 1911
Gesellschaft	British	147,946 of 1921
King	British	131,041 of 1919

[19]

LETTERS PATENT OF FOREIGN COUNTRIES (Continued)

Name of Patentee	Country Where Issued	Number of Date
Johnson	Danish	15,700 of 1912
Brown	British	29,833 of 1910
Johnson	Norwegian	22,331 of 1912
Oliver	French	404,286 of 1909
Oliver	British	12,857 of 1909
Evershed	British	16,895 of 1909
D'Arsonval	French	148,598 of 1882
Pollak	French	393,241 of 1908

PRIOR PRINTED PUBLICATIONS

"Nature" Vol. 17, Jan. 10, 1878, Page 201, Published by MacMillan & Co.

"Popular Science Monthly" Dec. 1978, Page 136,

"Electrical Engineer" London, January 20, 1899, Vol. 23, Pages 74-79.

"Engineering" London, Vol. 67, January 27, 1899, Pages 124-6.

"Electrical Engineer" New York, Pages 246-248, Vol. 37, March 2, 1899.

PRIOR USE

And for a further defense this defendant alleges that Edwin S. Pridham and Peter L. Jensen were not the original or first inventors of the thing sought to be patented in and by the several Letters Patent or either of them herein sued on, or of any material or substantial part thereof, but that long prior to the supposed invention thereof by Edwin S. Pridham and Peter L. Jensen the same was known to and used by Wilton L. Richards, at Malden and Boston, Massachusetts, and his present address is Brooklyn, New York; and by Frederick H. Vreeland, at Montclair, New Jersey, and New York [20] City, N. Y., and his present address is Brooklyn, New York, and also by the persons named as inventors in the patents hereinabove listed, such persons now residing, to the best of defendant's knowledge and belief, at the places specified in said patents and the prior use having been carried on at said places.

15.

And for a further and separate defense this defendant alleges that in view of the state of the art existing at the time of the alleged inventions sought to be patented in and by the patents in suit, no exercise of invention was required to produce the same, but on the contrary the same did not involve patentable invention but only the skill of those experienced in the art.

16.

For a furthr and separate defense this defendant alleges upon information and belief that by reason of the proceedings in the Patent Office during the prosecution of the applications which resulted in the patents in suit, and by the acts, admissions, statements and representations made by or on behalf of the applicants, each of the claims of said patents sued on is invalid and the plaintiff can not lawfully claim for any of said claims such construction or interpretation as would cover or conclude any apparatus employed by the defendants.

17.

And for a further and separate defense this defendant avers upon information and belief that the subject matter of each of the claims of the patents in suit was abandoned to the public because of unreasonable delay in making and asserting the same and because said claims were not presented until more than two years after the subject matter thereof had been [21] in public use in the United States or described in patents and printed publications and that the plaintiff is estopped to assert that the subject matter of any of said claims may be lawfully claimed and covered by the patents in suit.

18.

And for a further and separate defense this defendant alleges that more than a year prior to the institution of the case at bar and the filing of the

bill of complaint herein, the plaintiff herein, The Magnavox Company, instituted and filed in the District Court of the United States for the Eastern District of Pennsylvania at Philadelphia in the State of Pennsylvania, a suit in equity against the Atwater Kent Manufacturing Company, a corporation created and existing under the laws of Pennsylvania; that said suit was based on the same patents on which the suit at bar is based, to-wit: No. 1,266,988, issued on May 21, 1918, to Edwin S. Pridham and Peter L. Jensen, assignors to Commercial Wireless & Development Company, No. 1,448,279, issued on March 13, 1923 to Edwin S. Pridham and Peter L. Jensen, assignors to The Magnavox Company, and No. 1,579,392, issued on April 6, 1926, to Edwin S. Pridham and Peter L. Jensen, assignors to The Magnavox Company; that in and by the bill of complaint in said Philadelphia suit The Magnavox Company alleged that the Atwater Kent Manufacturing Company had infringed said three patents by manufacturing and selling devices which contained and embodied the inventions patented in and by said three patents, particularly claims 8 and 9 of Letters Patent No. 1,266,988 and claims 4, 8, 9 and 10 of Letters Patent No. 1,448,279, and claim 4 of Letters Patent No. 1,579,392; that in and by said bill of complaint The Magnavox Company prayed for injunctions, both preliminary and final enjoining and restraining the Atwater Kent Manufacturing Company from [22] further making and selling the alleged infringing devices and also

praying for an accounting of damages and profits for the devices made and sold by Atwater Kent Manufacturing Company in the usual form together with costs; that an answer has been filed in said suit *by* Atwater Kent Manufacturing Company and the case is now pending and undetermined though ready for trial at any convenient time;

That the pleadings and issues in said Philadelphia suit are the same as those in the case at bar;

That all the devices sold by defendant in the case at bar and charged to be infringements of the patents sued on were manufactured by the Atwater Kent Manufacturing Company at Philadelphia and sold by it to this defendant, and are a portion of the identical devices charged and claimed in the Philadelphia suit to be infringements of the patents in the suit at bar and in respect of which an injunctions and accounting is prayed for in both said Philadelphia suit and the suit at bar.

And defendant alleges on information and belief that if The Magnavox Company obtains a decree for damages and profits in the Philadelphia case and collects the same the defendant herein will be exempt and freed from the liability to pay damages and profits to the plaintiff herein, and the decree in the Philadelphia case and the collection of damages and profits therein will estop plaintiff from collecting any damages and profits from defendant herein; that the Atwater Kent Manufacturing Company is amply able to pay any and all

damages and profits that may be awarded against it in the said Philadelphia suit.

WHEREFORE, defendant prays judgment that it be hence dismissed with its costs and have such other and [23] further relief as may be just and equitable.

ERNEST INGOLD, INC.
[Seal] By Ernest Ingold
Pres.

Attest
MELVIN D. LYON
Secretary.

JOHN H. MILLER
A. W. BOYKEN
723 Crocker Building
San Francisco, Cal.
Attorneys and counsel for Defendant.

Receipt of a copy of the within Answer of Ernest Ingold, Inc., to the Bill of Complaint admitted this 24th day of June, 1930.

CHAS. E. TOWNSEND
WM. A. LOFTUS
for Plaintiff.

[Endorsed]: Filed Jun 24 1930 [24]

[Title of Court and Cause No. 2615-S.]

AMENDMENTS TO ANSWER

Now comes the defendant and by leave of Court first had and obtained files the following amendments to its Answer heretofore filed:

AMENDMENT No. 1

On Page 9, after line 19, add to the list of patents therein specified the following:

Name of Patentee	Date of Issuance	Number of Patent
Cheever	Jan. 22, 1884	292,203
Tommasina	May 13, 1902	700,161

AMENDMENT No. 2

On page 10, after line 20, add the following:

PRIOR KNOWLEDGE

And for a further and separate defense, this defendant alleges on information and belief that Edwin S. Pridham and Peter L. Jensen were not the original and first inventors or discoverers of the thing sought to be patented by the several letters patent or either of them herein sued [25] on, or any material or substantial part thereof, but that before the alleged invention thereof by said Edwin S. Pridham and Peter L. Jensen the same was known to the following named persons, viz:

Each of the patentees named in the list of patents pleaded in the Answer on pages 8, 9 and 10.

Radio Corporation of America,
residing at New York City.

Oliver Joseph Lodge,
residing at Liverpool, England.

Reginald A. Fessenden,
residing at Chestnut Hill, Mass.

Fritz P. Mansbendel,
residing at New York City.

Jesse B. Murphy,
residing at Wilkinsburg, Pennsylvania.
Clair L. Farrand,
residing at Stamford, Connecticut.
William H. Davis,
residing at New York City.
Edmond L. Ragonot,
residing at Paris, France.
Edward W. Kellogg,
residing at Schenectady, New York.

WHEREFORE, defendant renews the prayer of its original answer.

JOHN H. MILLER
A. W. BOYKEN
Attorneys for Defendant.

CONSENT TO FILING ABOVE AMENDMENT TO ANSWER

Plaintiff hereby consents to the filing of the above amendments to the answer of defendant without the necessity of a formal motion by defendant therefor.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff.

San Francisco, California,
February 11, 1932.

[Endorsed]: Filed Feb. 13, 1932. [26]

[Title of Court and Cause No. 2615-S.]

SECOND AMENDMENT TO ANSWER OF DEFENDANT.

Now comes defendant and by leave of Court files the following amendment to its answer, viz:

1. On page 10 line 19 of said answer change "Vol. 37" to Vol. 27.

2. On page 10 of said answer after line 19 add the following additional printed publication, viz:

The Electrician, pages 269-71, published at London, England, on December 16, 1898; also pages 307-9 of said publication, published December 23, 1898; also pages 366-7 of said publication, published January 6, 1899; also pages 402-5 of said publication, published January 13, 1899.

WHEREFORE, defendant renews the prayer of its answer.

JOHN H. MILLER
A. W. BOYKEN
N. D. THOMAS

March 8, 1932. Attorneys for Defendant.

Service of the within SECOND AMENDMENT TO ANSWER OF DEFENDANT admitted this 8th day of March, A. D. 1932, and consent to filing thereof is hereby given.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attys for Plaintiff.

[Endorsed]: Filed Mar 14 1932. [27]

[Title of Court and Cause No. 2615-S.]

ORDER FOR DEDIMUS POTESTATEM

Plaintiff having moved the Court for a dedimus potestatem to issue to take the testimony of one EDWARD E. ROBINSON, of Egham, Surrey, England, and one OLIVER LODGE, Royal Society, London, England, and possibly others, material witnesses for plaintiff and whose testimony is necessary to prevent a failure or delay of justice, and both parties being represented by counsel.

Now, for good cause shown, it is ORDERED that a dedimus potestatem be issued in this cause out of this Court, directed to the United States Consul or to such Deputy or representative of such Consul as may be authorized by him to act in his place and stead, at London, England, to examine the following named persons, under oath, as witnesses herein, to-wit:

EDWARD E. ROBINSON, of Egham, Surrey, England;

OLIVER LODGE, Royal Society, London, England, and possibly others.

It is further ORDERED that the examinations above provided for shall take place some time between November 16, 1931 and November 28, 1931.

It is further ORDERED that all directions herein contained as to time, place and order and manner of examination [28] of said witnesses may be changed or modified with the written consent of the counsel for the respective parties in London, England.

It is further ORDERED that prior to the 30th day of October, 1931, the attorneys for the plaintiff shall

give notice in writing of the names and European address or addresses of the witnesses to be examined and the date, hour and place where the taking of said depositions shall begin.

It is further ORDERED that prior to the 5th day of November, 1931, the attorneys for the respective parties shall give notice, each to the other, of the names and European address of the counsel for the respective parties who are to take or attend the taking of testimony under this commission.

It is further ORDERED that the examination of all witnesses under this commission shall be oral, or taken by question and answer in the usual manner of taking oral depositions by examination, cross-examination and redirect examination; and that the testimony given under such examination may be taken down in shorthand and shall be reduced to writing, signed by the witnesses and certified by the Commissioner and by him transmitted by mail to the Clerk of this Court at the City and County of San Francisco, State of California, unless otherwise mutually agreed upon by counsel for both parties.

It is further ORDERED that all testimony taken under the commission provided for herein shall be taken subject to all legal objections as to competency, relevancy and/or materiality at the trial of this cause.

A. F. ST. SURE

Judge of the United States District Court for the Northern District of California, third Division.

Dated: October 27, 1931.

[Endorsed]: Filed Oct 27 1931. [29]

[Title of Court and Cause No. 2615-S.]

STIPULATION IDENTIFYING DEFENDANTS' LOUD SPEAKER IN SUIT, AND RE CERTAIN DEPOSITIONS

IT IS STIPULATED AND AGREED by the parties hereto that the drawing attached hereto marked "Plaintiff's Exhibit A-1" is a true and correct drawing of Loud Speaker manufactured by Atwater Kent Manufacturing Company and sold in this district by defendant, Ernest Ingold, Inc., within six years last past.

IT IS FURTHER STIPULATED AND AGREED that the testimon*t* and/or depositions heretofore offered by plaintiff in the cases of The Magnavox Company v. Frederick H. Thompson Company, No. 2166-S, In Equity, and The Magnavox Company v. Hart & Reno, et al., No. 2534-S, In Equity, of the witnesses Bernard B. Linden, Stafford Warner, Chris Eiferle, and Harry I. Zemansky, may be received in this case with the same force and effect as if the witnesses had appeared and testified especially in this cause.

CHAS. E. TOWNSEND
WM. A. LOFTUS
THOS. G. GOULDEN
Attorneys for Plaintiff.
JOHN H. MILLER
A. W. BOYKEN
Attorneys for Defendant.

Dated: March 28, 1932.

(Attached hereto is blue print of Cross Section of Atwater Kent Loud Speaker. Plaintiff's Exhibit A-1)

[Endorsed]: Filed Mar 29 1932. [30]

[Title of Court and Cause Nos. 2615-S and 2616-S]

MEMORANDUM AND ORDER

Two suits brought by The Magnavox Company, a corporation, alleging infringement of two of its patents, involving the same issues, were consolidated for trial. The claims sued upon are No. 8 of Patent No. 1,266,988 and No. 8 of Patent No. 1,448,279. The defenses are invalidity and non-infringement.

Adopting the course followed by the Circuit Court of Appeals of the Second Circuit in Lektophone Corporation v. Sylo Lighting Fixture Co., 16 Fed. (2d) 7, and in Lektophone Corporation v. Western Electric Co., 16 Fed. (2d) 10, and by the Circuit Court of Appeals of the Ninth Circuit in Lektophone Corporation v. Rola Co., 34 Fed. (2d) 764, 773, I find it unnecessary to pass upon the validity of the patents, limited as their interpretation must be by the state of the prior art. And after careful study of the patents, the prior art. And after careful study of the patents, the prior art, the law, and the facts, I have reached the conclusion that there is no infringement of Claim 8 of either patent, and so find. The complainants will be dismissed with costs to

defendants. Findings of fact and conclusions of law in accordance with Rule 42. [31]

So ordered.

A. F. ST. SURE

March 17, 1933. United States District Judge.

[Endorsed]: Filed Mar 18 1933. [32]

[Title of Court.]

AT A STATED TERM of the Southern Division of the United States District Court for the Northern District of California, held at the Court Room thereof, in the City and County of San Francisco, on Saturday, the 18th day of March, in the year of our Lord one thousand nine hundred and thirty-three.

PRESENT: the Honorable A. F. ST. SURE, District Judge.

No. 2615-

[Title of Cause.]

This cause heretofore tried and submitted, being fully considered, and the Court having filed its Memorandum and Order thereon, it is, in accordance with said Memorandum and Order, Ordered that the bill of complaint herein be and the same is hereby dismissed with costs to the defendant and that a decree be signed, filed and entered herein accordingly upon Findings of Fact and Conclusions of Law to be prepared and filed in accordance with Rule 42. [33]

[Title of Court and Cause No. 2615-S.]

PLAINTIFF'S OBJECTIONS AND EXCEPTIONS TO DEFENDANT'S PROPOSED FINDINGS AND CONCLUSIONS, AND PLAINTIFF'S PROPOSED FINDINGS AND CONCLUIONS IN LIEU OF AND ADDITIONAL TO THOSE PROPOSED BY DEFENDANT.

Plaintiff objects to the following-designated Conclusions of Law proposed by defendant's counsel and served herein on or about March 23, 1933, and requests the allowance of an exception wherever any such objection may be overruled.

I.

Plaintiff objects to proposed Conclusions of Law designated Numbers "2" to "6", inclusive, on the ground that the same are contrary to law and the evidence.

II.

Plaintiff proposes the following Findings of Facts, in addition to those proposed by defendant:

5.

That the patents in suit, and particularly the claims thereof declared upon herein, have heretofore been found valid, in a contested case tried in this Court and entitled "The Magnavox Company vs. Frederick H. Thompson Company," decided April 9, 1930.

6.

That in said prior adjudication said patents were held to be infringed by a structure substantially similar to the structure involved herein.

7.

That the prior art relied upon herein is substantially the same as was presented in said suit of Magnavox vs. Frederick H. Thompson Company.

8.

That there is no proof that any loud speaker had been [34] conceived or constructed prior to plaintiff's Patent Number 1,266,988, embodying the combination of elements set forth in Claim 8 thereof.

9.

That the proofs show that the combination of elements specified in Claim 8 of said Patent 1,266,988 accomplished a new and useful result in respect to overcoming breakage of fine wires leading from the moving coil to the stationary binding posts, by securing said wires to the surface of the diaphragm.

10.

That there is no proof that any loud speaker had been conceived or constructed prior to plaintiff's Patent 1,448,279, embodying the combination of elements set forth in Claim 8 thereof.

11.

That the proofs show that the combination of elements specified in Claim 8 of said Patent 1,448,279

accomplished a new and useful result in respect to accurate and fine spacing of the central pole piece and circumferential pole piece and the maintenance of the moving coil in said space by affixing it to the outer pole piece and housing or sound box which supports the diaphragm to which said movable coil in turn is secured.

12.

That prior to the inventions of the patents in suit there was not in existence any commercial loud speaker of the moving coil or dynamic type.

13.

That a demand had long existed for a loud speaker of the moving coil or dynamic type, because of its superiority over the iron armature type with respect to volume and faithfulness of reproduction. [35]

14.

That the patentees of the patents in suit, through their assignee, plaintiff herein, in and by the combinations set forth in the patents in suit fulfilled said demand, and the commercial devices produced thereunder were widely sold and publicly acclaimed.

15.

That in respect to the Lodge defense, the proofs show that the structures of the Lodge patent and publications were never actually constructed or operated, except in one form which did not embody the lead-out wires secured to the diaphragm, as in Claim 8 of Patent 1,266,988, or the spacing means

of Claim 8 of Patent 1,448,279; and that the only use made of said device by Lodge was in the nature of a Laboratory demonstration.

16.

That none of the devices depicted in or described in the other prior patents and publications relied upon, is shown to have been put to practical or commercial use for loud speaking purposes.

17.

That the combinations covered by Claim 8 of Patent 1,266,988, and Claim 8 of Patent 1,448,279, constitute inventions.

III.

And as Conclusions of Law, plaintiff proposes the following in lieu of defendant's proposed Conclusions designated "2" to "6":

2.

That Patent 1,266,988, particularly Claim 8 thereof, is valid. [36]

3.

That Patent 1,448,279, particularly Claim 8 thereof, is valid.

4.

That the loud speakers sold by defendant Ernest Ingold, Inc., complained of in the Bill of Complaint herein, more particularly identified as Plaintiff's Exhibit 4, constitute an infringement of Claim 8 of said Patent 1,266,988 and Claim 8 of said Patent 1,448,279.

5.

That a decree be entered as prayed, and a Master appointed to state an accounting of all damages and profits.

CHAS. E. TOWNSEND,
WM. A. LOFTUS,
Attorneys for Plaintiff.

Dated: Mar. 28/33.

Service of copy of the within Plaintiff's Objections and Exceptions to Defendant's Proposed Findings and Conclusions, and Plaintiff's Proposed Findings and Conclusions in Lieu of and Additional to Those Proposed by Defendant, admitted this 28th day of March, A. D. 1933.

JOHN H. MILLER,
A. W. BOYKEN,
for Defendant.

[Endorsed]: Lodged Mar. 29, 1933. [37]

[Title of Court.]

AT A STATED TERM of the Southern Division of the United States District Court for the Northern District of California, held at the Court Room thereof, in the City and County of San Francisco, on Monday, the 10th day of April, in the year of our Lord one thousand nine hundred and thirty-three.

PRESENT: the Honorable A. F. ST. SURE, District Judge.

[Title of Cause.]

No. 2615

After hearing A. Dunham Owen, Esq., for plaintiff, it is Ordered that the plaintiff's objections and exceptions to defendant's proposed findings and conclusions be and the same are hereby overruled and plaintiff allowed an exception to the ruling of the Court. [38]

[Title of Court and Cause No. 2615-S.]

FINDINGS OF FACT AND CONCLUSIONS OF LAW.

This cause having come on regularly to be heard upon pleadings and proof at this term of court, the parties being represented by counsel and the cause having been argued and duly submitted, upon consideration thereof the Court finds the following facts and conclusions of law.

Findings of Fact.

1.

That plaintiff, The Magnavox Company, is a corporation, organized and existing under the laws of the State of Arizona, with a place of business in the City of Oakland, State of California.

2.

That defendant, Ernest Ingold, Inc., is a corporation, organized and existing under the laws of the

State of California, with a place of business in the City and County of San Francisco, State of California.

3.

That plaintiff, The Magnavox Company, is the owner and holder of all right, title and interest in and to Letters Patent of the United States No. 1,266,988, dated May 21, 1918, and No. 1,448,279, dated March 13, 1923.

4.

That defendant, Ernest Ingold, Inc., has sold, in San Francisco, California, and elsewhere, certain loudspeakers complained of in the bill of complaint herein and more particularly identified as Plaintiff's Exhibit 4 in the transcript of testimony.

Conclusions of Law.

1.

That this court has jurisdiction of the parties hereto and the subject matter hereof. [39]

2.

That this court finds it unnecessary to pass upon the validity of the patents in suit, limited as their interpretation must be by the state of the prior art.

3.

That the loudspeakers sold by defendant, Ernest Ingold, Inc., complained of in the bill of complaint herein and more particularly identified as Plaintiff's Exhibit 4, are not any infringement of claim

8 of Patent No. 1,266,988 nor claim 8 of Patent No. 1,448,279, these being the only two claims in suit.

4.

That plaintiff, The Magnavox Company, is not entitled to the relief prayed for in its bill of complaint, or any part thereof.

5.

That the bill of complaint herein be dismissed.

6.

That defendant, Ernest Ingold, Inc., recover from plaintiff its costs of suit.

A. F. ST. SURE,
U. S. District Judge.

April 1, 1933.

Receipt of a copy of the within Findings of Fact and Conclusions of Law admitted this 23rd day of March, 1933.

TOWNSEND & LOFTUS,
Attorneys for Plaintiff.

[Endorsed]: Filed Apr. 1, 1933. [40]

In the United States District Court for the Northern District of California, Southern Division.

In Equity No. 2615-S

THE MAGNAVOX COMPANY,

Plaintiff,

vs.

ERNEST INGOLD, INC.,

Defendant.

FINAL DECREE OF DISMISSAL.

This cause came on to be heard at this term and was argued by counsel and submitted to the Court for decision; and upon consideration thereof it was

ORDERED, ADJUDGED AND DECREED

That defendant above named has not infringed claim 8 of plaintiff's patent No. 1,266,988 nor claim 8 of plaintiff's patent No. 1,448,279, said two claims being the only claims in suit, and that the bill of complaint herein be and the same is hereby dismissed with costs to defendant taxed in the sum of $205.23.

Dated: April 1, 1933.

A. F. ST. SURE,
United States District Judge.

Approved as to form:

CHAS. E. TOWNSEND,
WM. A. LOFTUS,
Attorneys for Plaintiff.

[Endorsed]: Filed and entered Apr. 1, 1933. [41]

United States District Court, Northern District of California, Southern Division.

In Equity No. 2616-S

THE MAGNAVOX COMPANY, a corporation,
Plaintiff,

vs.

STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation; and GARNETT YOUNG & CO., a corporation,
Defendants.

Patent Infringement:
Patent 1,266,988, Patent 1,448, 279, Patent 1,579,392

BILL OF COMPLAINT.

Comes now THE MAGNAVOX COMPANY, plaintiff above named, and complains of STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation, and GARNETT YOUNG & CO., a corporation, above-named defendants, and for cause of action alleges:

I.

That the plaintiff, THE MAGNAVOX COMPANY, during all the times hereinafter mentioned was and is a corporation duly organized and existing under and by virtue of the laws of the State of Arizona, with a place of business in the City of Oakland, County of Alameda, State of California.

II.

That the defendant STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY is a corporation organized under the laws of the State of New York, with a regular and established place of business in the City and County of San Francisco, State of California; that the defendant GARNETT YOUNG & CO. is a California corporation with a place of business in the City and County of San Francisco, State of California. [42]

III.

That the jurisdiction of the Court depends upon the Patent Laws of the United States.

IV.

That prior to the 3rd day of July, 1916, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful improvements in Amplifying Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter-recited application for Letters Patent therefor, and not in public use or on sale in this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve

months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements, under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on the 3rd day of July, 1916, file in the Patent Office of the United States a joint application for Letters Patent on said invention; that said application was duly assigned to Commercial Wireless & Development Company, a corporation organized under the laws of the State of Arizona, before the issuance of said Letters Patent, by assignment duly recorded in the Patent Office of the United States. That thereafter, to-wit, on May 21, 1918, all requirements of the statutes then in force having been complied with, Letters Patent of the United States for said invention, signed, sealed, and executed in due form of law, were duly issued to [43] the said Commercial Wireless & Development Company as assignee of the entire, right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,266,988, and said Letters Patent or a duly certified copy thereof are ready to be produced as this Court shall direct.

V.

That the Plaintiff, The Magnavox Company, by written assignment is now the sole and exclusive owner of the entire right, title and interest in and to the aforesaid Letters Patent 1,266,988, including all rights to recover for past infringement thereof.

VI.

That prior to the 28th day of April, 1920, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful improvements in Electrodynamic Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter-recited application for Letters Patent therefor, and not in public use or on sale in this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements, under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on the 28th day of April, 1920, file in the Patent Office of the United States a joint Application for Letters Patent on said invention; that said application [44] was duly assigned to Plaintiff, The Magnavox Company, before the issuance of said Letters Patent, by an assignment duly recorded in the Patent Office; that thereafter, to-wit, on the 13th day of March, 1923, all requirements of the statutes then in force having been complied with,

Letters Patent of the United States for said invention, signed, sealed, and executed in due form of law, were duly issued to the said The Magnavox Company, as assignee of the entire right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,448,279, and said Letters Patent or a duly certified copy thereof, are ready to be produced as this Court shall direct.

VII.

That prior to the 20th day of March, 1922, Edwin S. Pridham and Peter L. Jensen were the true, original, first and joint inventors of certain new and useful improvements in Electrodynamic Receivers, not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than two years prior to their hereinafter recited application for Letters Patent therefor, and not in public use or on sale in this country for more than two years prior to their said application, and for which no application for Letters Patent in any country foreign to the United States of America had been filed more than twelve months prior to the filing of the application in this country, and which had not been abandoned; and that being entitled to a patent for said improvements, under the provisions of the Statutes of the United States then in force, said Edwin S. Pridham and Peter L. Jensen did, on

the 20th day of March, 1922, file in the Patent Office of the United States a joint application for [45] Letters Patent on said invention; that said application was duly assigned to Plaintiff, The Magnavox Company, before the issuance of said Letters Patent by an assignment duly recorded in the Patent Office; that thereafter, to wit on the 6th day of April, 1926, all requirements of the statutes then in force having been complied with, Letters Patent of the United States for said invention, signed, sealed and executed in due form of law, were duly issued to the said The Magnavox Company, as assignee of the entire right, title and interest therein and thereto; that the Letters Patent so issued were numbered 1,579,392, and said Letters Patent or a duly certified copy thereof, are ready to be produced as this Court shall direct.

VIII.

That Plaintiff is still the owner of all right, title, and interest in and to the aforesaid inventions, and in and to the aforesaid Letters Patents.

IX.

That the inventions of the several Letters Patents aforesaid are capable of conjoint use, and have been so used by Defendants herein.

X.

That the said inventions patented as aforesaid are of great value and utility to Plaintiff, and to

the public generally; that the Plaintiff and its licensees, since the dates of said inventions, have caused to be manufactured and sold great numbers of said devices embodying the inventions of said Letters Patent and each of them; that Plaintiff has expended large sums of money in causing the said inventions to be developed; and has built up a large and profitable business for the exploitation of said devices, so that the said inventions and patent rights have been and are of great utility and great [46] value to the Plaintiff and its licensees, and, but for the unlawful acts of the Defendants herein complained of, would have been of greater value and profit to them.

XI.

That the devices caused to be manufactured and sold by Plaintiff and its licensees, embodying the inventions of the aforesaid Letters Patents, and each of them, have been and are duly marked "Patented", with the date and/or number of each of said Letters Patents, all in the manner prescribed by the Statutes of the United States; and Plaintiff's ownership of said inventions and Letters Patents has been widely recognized and acquiesced in by the public and by the trade generally.

XII.

Plaintiff further shows that on the 16th day of August, 1928, it filed a suit in equity in the District Court of the United States for the Northern District of California, Southern Division, against Frederick H. Thompson Company, defendant, for

the infringement of the said Letters Patents here in suit, being suit in Equity No. 2166-S; that the pleadings in the said cause were in the usual form; that the said Letters Patents were assailed for want of invention and novelty and that the said Edwin S. Pridham and Peter L. Jensen were not the original and first inventors and discoverers of the subject matter of the said Letters Patents or of any material or substantial part thereof, and that the same or material or substantial parts thereof had been in public use and on sale in this country prior to said invention and for more than two years prior to the respective applications for said Letters Patents, and that the same had been described and illustrated in printed publications prior to the dates of said inventions of said Edwin S. Pridham and Peter L. Jensen; that after a trial before said Court and the examination of wit- [47] nesses and the introduction of documentary evidence by the respective parties and the evidence being closed and argued by the respective parties the cause was submitted to the Court; and after due consideration said Court on the 9th day of April, 1930, sustained said patents and each of them and adjudged the same to be valid in all respects, holding that said patents and each of them represented a new, useful and patentable invention, and that the same was infringed.

XIII.

That, well knowing the premises, and with intent to injure and defraud the Plaintiff, the Defendants

have jointly and severally and since the grant of said Letters Patents and each of them, and within six years prior to the filing of this Bill of Complaint, and within the Northern District of California, and elsewhere within the United States, infringed upon said Letters Patents and each of them, by making and/or selling and/or using devices embodying the inventions of each of said Letters Patents, which said devices infringed and infringe upon said Letters Patents and each of them and each and all of the claims thereof, by making and/or selling devices embodying the inventions of each of said Letters Patents and of the several claims thereof, all without the license or consent of Plaintiff and in defiance of Plaintiff's rights, and threaten to continue to so infringe, all to the great and irreparable damage of the Plaintiff and to the unlawful gain and profit of the Defendants.

WHEREFORE, Plaintiff prays a decree of this Court against the Defendants and each of them, as follows:

First. That upon the filing of this Bill of Complaint a preliminary injunction be granted, enjoining and restraining the Defendants, and each of them, their respective agents, servants, attorneys, and employees, pendente lite, from making, using or selling any apparatus which infringes upon said [48] Letters Patents, in violation of Plaintiff's rights aforesaid.

Second. That upon the final hearing defendants, and each of them, their respective servants, agents, attorneys and employees be permanently and finally enjoined and restrained from making, using or selling any device, machine or apparatus which infringes upon said Letters Patents Numbers 1,266,988, 1,448,279, and 1,579,392, in violation of plaintiff's rights as aforesaid, and that a writ of injunction be issued out of and under the seal of this Court enjoining the said defendants and each of them, their respective agents, servants, attorneys and employees, as aforesaid.

Third. That plaintiff have and recover from the defendant the profits realized by the defendants respectively and the damages sustained by the plaintiff from and by reason of the infringement aforesaid, together with costs of suit, and that the said damages be trebled by reason of the willful nature of the infringement by defendants herein, and that plaintiff have such other and further relief as to the Court may seem proper and in accordance with equity and good conscience.

CHAS. E. TOWNSEND
WM. A. LOFTUS
THOS. G. GOULDEN
Attorneys for Plaintiff. [49]

State of California
City and County of San Francisco—ss.

On this 15th day of April, 1930, before me personally appeared EDWIN S. PRIDHAM, who, being by me duly sworn, deposes and says that he is

Vice-President of THE MAGNAVOX COMPANY, the Plaintiff herein; that he has read the foregoing Bill of Complaint, and that the statements therein contained are true, of his own knowledge, except so far as they are alleged to be stated on information and belief, as to which statements deponent believes them to be true.

EDWIN S. PRIDHAM

Sworn to and subscribed before me this 15th day of April, 1930.

[Seal] W. W. HEALEY

Notary Public, City and County of San Francisco State of California.

My commission expires August 29, 1933.

[Endorsed]: Filed, April 16, 1930. [50]

[Title of Court and Cause No. 2616-K.]

ANSWER

The defendants, Stromberg Carlson Telephone Manufacturing Company and Garnett Young & Co., answering the bill of complaint allege as follows:

1. Answering paragraph I of said bill, defendants are without knowledge of the matters alleged in said paragraph, and therefore deny the same.

2. Answering paragraphs II and III of said bill, defendants admit the allegations contained in said paragraphs.

3. Answering paragraph IV of said bill, defendants admit that on or about July 3rd, 1916, Edwin

S. Pridham and Peter L. Jensen filed in the United States Patent Office an application for Letters Patent, and that on May 21, 1918, Letters Patent No. 1,266,988, issued to the Commercial Wireless & Development Company, and defendants, upon information and belief, deny each and all of the remaining allegations in said paragraph IV.

4. Answering paragraph V of said bill, defendants are without knowledge of the matters alleged in said paragraph and therefore deny the same.

5. Answering paragraph VI of said bill, defendants admit that on or about April 28, 1920 Edwin S. Pridham and Peter L. [51] Jensen filed in the United States Patent Office an application for Letters Patent, and that on March 13, 1923, Letters Patent No. 1,448,279 issued to The Magnavox Company, and defendants, upon information and belief, deny each and all of the remaining allegations in said paragraph VI.

6. Answering paragraph VII of said bill, defendants admit that on or about March 20, 1922 Edwin S. Pridham and Peter L. Jensen filed in the United States Patent Office an application for Letters Patent and that on April 6, 1926, Letters Patent No. 1,579,392 issued to The Magnavox Company, and defendants, upon information and belief, deny each and all of the remaining allegations in said paragraph VII.

7. Answering paragraph VIII of said bill, defendants are without knowledge of the matters alleged in said paragraph and therefore deny the same.

8. Answering paragraph IX of said bill, defend-

ants deny the allegations contained in said paragraph.

9. Answering Paragraphs X and XI of said bill, defendants are without knowledge of the matter alleged in said paragraphs and therefore deny the same.

10. Answering Paragraph XII of said bill, defendants admit that plaintiff filed a suit in equity in the District Court of the United States for the Northern District of California, Southern Division, against Frederick H. Thompson Company for infringement of the said letters Patent here in suit, and that said suit was heard and that a decree was rendered in favor of the plaintiff, but defendants are without knowledge of the other matters alleged in said paragraph and therefore deny each and all of the remaining allegations in said paragraph.

11. Answering paragraph XIII of said bill, defendants deny each and all of the allegations contained in said paragraph.

12. Defendants, upon information and belief, allege that [52] each of the claims of the patents in suit is invalid and void because Edwin S. Pridham and Peter L. Jensen were not the original and first inventors of the subject matter of any of the claims of said patents, or of any substantial or material part thereof, but that the same in all their material and substantial parts, before the alleged inventions or discoveries thereof, more than two years prior to the filing dates of the applications, and more than two years before claims therefore were made, were known and used by others in this country, and were patented and described in printed publications in this and foreign countries. The patents and printed publications above referred to, insofar as they at present have been ascertained are as follows:

UNITED STATES PATENTS

Patentee	Number	Issue Date
Siemens	149,797	April 14, 1874
Edison	203,013	April 30, 1878
Eccard	214,029	April 8, 1879
Cook	227,736	May 18, 1880
Morris	236,239	January 4, 1881
Russell	238,253	March 1, 1881
Bell	241,184	May 10, 1881
Milliken	262,811	August 15, 1882
Cheever	281,240	July 17, 1883
Rogers	297,168	April 22, 1884
Taylor	305,980	September 30, 1884
Taylor	314,155	March 17, 1885
Emmner	346,031	July 20, 1886
Mather	387,310	August 7, 1888
Rose	354,241	December 14, 1886
Vogt	476,583	June 7, 1892
Perry	485,123	November 15, 1892
Perry	509,095	November 21, 1893
Richards	521,220	June 12, 1894
Shreeve	602,174	April 12, 1898
Burns	623,702	April 25, 1899
Tommasina	700,161	May 13, 1902
Dean	817,140	April 3, 1906
Kaisling	903,197	November 10, 1908
Pearson	903,745	November 10, 1908
Vreeland	930,508	August 10, 1909
Vreeland	936,684	October 12, 1909
Pollak	939,625	November 9, 1909
Oliver	951,695	March 8, 1910

Patentee	Number	Issue Date
Johnsen	1,075,786	October 14, 1913
Jensen & Pridham	1,088,283	February 24, 1914
Pridham & Jensen	1,105,924	August 4, 1914

[53]

BRITISH PATENTS

Siemens	4,685 of 1877	
Thompson	11,501 of 1885	
Lodge	9,712 of 1898	April 27, 1898
Evershed	16,895 of 1909	July 20, 1909
Brown	29,833 of 1910	
King	131,041	
Signal Gesellschaft, etc.	147,946	Oct. 10, 1921 (Accepted)

FRENCH PATENTS

Brown	27,812 of 1924

NORWEGIAN PATENTS

Johnson	22,331

DANISH PATENTS

Johnson-	15,700

PUBLICATIONS

Nature, January 10, 1878, Article by Romanis, p. 201

Popular Science, 1878, Edison Telephone, p. 136

Physikalische Zeitschrift, Vol. 10, No. 9, Moving Coil Telephone, pp. 310, 312

Electrical Engineer, March 2, 1899, Article by Lodge, pp. 246-7

Institute of Electrical Engineers, London, Vol. XXVII, No. 565, (1898) Article by Lodge.

And by other letters patent and publications which defendant prays leave to add hereto by amendment when ascertained.

13. Defendants, upon information and belief, allege that the said Edwin S. Pridham and Peter L. Jensen were not the original and first inventors of any of the alleged improvements described and claimed in any of the patents in suit, but the same, in all their material and substantial parts, before the alleged inventions or discoveries thereof, were invented by, known to, and/or used by the persons named as inventors in the patents listed in paragraph 12 hereof, such [54] persons now residing, to the best of defendant's knowledge and belief, at the places specified in said patents, and also by other persons whose names are at present unknown to the defendants, but which, when known, defendants pray leave to insert in this answer by amendment.

14. Defendants allege, upon information and belief, with respect to each of the claims of the patents here in suit, that it is invalid and void, because in view of the state of the art at the time of the alleged invention thereof, no exercise of invention was required to produce the apparatus purporting to be patented by any of said claims, but, on the contrary, the production of said apparatus did not involve patentable invention, being merely the expected skill of those experienced in the art.

15. Defendants allege, upon information and belief, that by reason of the proceedings in the Patent Office during the prosecution of the applications which resulted in the patents here in suit, and by the acts, admissions, statements, and representations

made by or on behalf of the applicants, each of the claims of the said patents is invalid, and the plaintiff cannot validly claim for any of said claims such construction or interpretation, were the same otherwise possible, as would cause any of the claims to cover and include any apparatus employed by the defendants.

16. Defendants, upon information and belief, allege that the subject matter of each of the patents here in suit was abandoned to the public, because of unreasonable delay in making and asserting the claims; because said claims were not presented until more than two years after the subject matter thereof had been in public use in the United States and/or described in patents and printed publications; and that the plaintiff is estopped to assert that the subject matter of any of said claims may be validly claimed in the said [55] patents in suit.

WHEREFORE, defendants pray that the said bill of complaint be dismissed with costs to the defendants.

STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY,
By W. Roy McCanne,
President.
GARNETT YOUNG & CO.,
By Miller & Boyken.
JOHN H. MILLER,
A. W. BOYKEN,
Solicitors for Defendants.
D. CLYDE JONES,
Counsel for Defendants.

State of New York,
County of Monroe.—ss.

W. Roy McCanne, being duly sworn, deposes and says that he is President of STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, one of the defendants herein, that he has read the foregoing answer and knows the contents thereof; that the same is true of his own knowledge except as to the matters therein stated to be alleged upon information and belief, and that as to those matters he believes it to be true.

W. ROY McCANNE.

Sworn to before me this 10th day of June, 1930.
[Seal] ALBERT G. KOBER,
Notary Public.

[Endorsed]: Receipt of a copy of the within Answer admitted this 13th day of September, 1930.
CHAS. E. TOWNSEND,
WM. A. LOFTUS,
Attorney for Plaintiff.

Filed September 15, 1930. [56]

[Title of Court & Cause No. 2616-S.]

AMENDMENTS TO ANSWER.

Now come the defendants and by leave of Court first had and obtained files the following amendments to their Answer heretofore filed:

AMENDMENT NO. 1.

On page 9, after line 19, add to the list of patents therein specified the following:

Name of Patentee	Date of Issuance	Number of Patent
Cheever	Jan. 22, 1884	292,203
Tommasina	May 13, 1902	700,161

AMENDMENT NO. 2.

On page 10, after line 20, add the following:

PRIOR KNOWLEDGE.

And for a further and separate defense, these defendants allege on information and belief that Edwin S. Pridham and Peter L. Jensen were not the original and first inventors or discoverers of the thing sought to be patented by the several letters patent or either of them herein sued on, or any material or substantial part thereof, but that before the alleged invention thereof by said Edwin S. Pridham and Peter L. Jensen the same was known to the following named persons, viz:

Each of the patentees named in the list of patents pleaded in the Answer on pages 8, 9, and 10.

Radio Corporation of America,
residing at New York City.

Oliver Joseph Lodge,
residing at Liverpool, England.

Reginald A. Fessenden,
residing at Chestnut Hill, Mass.

Fritz P. Mansbendel,
residing at New York City.

Jesse B. Murphy,
residing at Wilkinsburg, Pennsylvania. [57]
Clair L. Farrand,
residing at Stamford, Connecticut.
William H. Davis,
residing at New York City.
Edmond L. Ragonot,
residing at Paris, France.
Edward W. Kellogg,
residing at Schnectady, New York.

WHEREFORE, defendants renew the prayer of their original answer.

JOHN H. MILLER,
A. W. BOYKEN,
Attorneys for Defendants.

CONSENT TO FILING ABOVE AMENDMENT TO ANSWER.

Plaintiff hereby consents to the filing of the above amendments to the answer of defendants without the necessity of a formal motion by defendants therefor.

CHAS. E. TOWNSEND,
WM. A. LOFTUS,
Attorneys for Plaintiff.

San Francisco, California,
February 11, 1932.

[Endorsed]: Filed Feb. 13, 1932. [58]

[Title of Court & Cause No. 2616-S.]

SECOND AMENDMENT TO ANSWER OF DEFENDANT.

Now comes defendant and by leave of Court files the following amendment to its answer, viz:

On page 5 after line 25 add the following additional printed publication, viz:

The Electrician, pages 262-71, published at London, England, on December 16, 1898; also pages 305-9 of said publication, published December 23, 1898; also pages 366-7 of said publication, published January 6, 1899; also pages 402-5 of said publication, published January 13, 1899.

WHEREFORE, defendant renews the prayer of its answer.

JOHN H. MILLER,
A. W. BOYKEN,
N. D. THOMAS,
Attorneys for Defendant.

March 8, 1932.

[Endorsed]: Service of the within Second Amendment to Answer of Defendant admitted this 8th day of March, A. D. 1932, and consent to filing thereof is hereby given.

CHAS. E. TOWNSEND,
WM. A. LOFTUS,
Attorneys for Plaintiff.

Filed March 14, 1932. [59]

[Title of Court and Cause No. 2616-S.]

STIPULATION IDENTIFYING DEFENDANTS' LOUD SPEAKER IN SUIT, AND RE CERTAIN DEPOSITIONS.

IT IS STIPULATED AND AGREED by the parties hereto that the drawing attached hereto marked "Plaintiff's Exhibit A-1" is a true and correct drawing of Loud Speaker manufactured by defendant Stromberg-Carlson Telephone Manufacturing Company, and sold in this district by defendant Garnett Young & Co., within six years last past.

IT IS FURTHER STIPULATED AND AGREED that the testimony and/or depositions heretofore offered by plaintiff in the cases of The Magnavox Company v. Frederick H. Thompson Company, No. 2166-S, In Equity, and The Magnavox Company v. Hart & Reno, et al., No. 2534-S, In Equity, of the witnesses Bernard B. Linden, Stafford Warner, Chris Eiferle, and Harry I. Zemansky, may be received in this case with the same force and effect as if the witnesses had appeared and testified especially in this cause.

CHAS. E. TOWNSEND,
WM. A. LOFTUS,
THOS. G. GOULDEN,
Attorneys for Plaintiff.

JOHN H. MILLER,
A. W. BOYKEN,
Attorneys for Defendant.

Dated: March 28, 1932.

(Here follows drawing of cross-section of Stromberg Carlson Loud Speaker being Plaintiff's Exhibit No. 2.)

[Endorsed]: Filed Mar. 29, 1932. [60]

[Title of Court and Cause Nos. 2516-S and 2616-S.]

MEMORANDUM AND ORDER

Two suits brought by The Magnavox Company, a corporation, alleging infringement of two of its patents, involving the same issues, were consolidated for trial. The claims sued upon are No. 8 of Patent No. 1,266,988 and No. 8 of Patent No. 1,448,279. The defenses are invalidity and noninfringement.

Adopting the course followed by the Circuit Court of Appeals of the Second Circuit in Lektophone Corporation v. Sylo Lighting Fixture Co., 16 Fed. (2d) 7, and in Lektophone Corporation v. Western Electric Co., 16 Fed. (2d) 10, and by the Circuit Court of Appeals of the Ninth Circuit in Lektophone Corporation v. Rola Co., 34 Fed. (2d) 764, 773, I find it unnecessary to pass upon the validity of the patents, limited as their interpretation must be by the state of the prior art. And after careful study of the patents, the prior art, the law, and the facts, I have reached the conclusion that there is no infringement of Claim 8 of either patent, and so find. The complaints will

be dismissed with costs to defendants. Findings of fact and conclusions of law in accordance with Rule 42.

So ordered.

A. F. ST. SURE
United States District Judge.

March 17, 1933.

[Endorsed]: Filed Mar 18 1933 [61]

[Title of Court.]

AT A STATED TERM of the Southern Division of the United States District Court for the Northern District of California, held at the Court Room thereof, in the City and County of San Francisco, on Saturday, the 18th day of March, in the year of our Lord one thousand nine hundred and thirty-three.

PRESENT: the Honorable A. F. St. Sure, District Judge.

No. 2616

[Title of Cause.]

This cause heretofore tried and submitted, being fully considered, and the Court having filed its Memorandum and Order thereon, it is, in accordance with said Memorandum and Order, Ordered that the bill of complaint herein be and the same is hereby dismissed with costs to the defendants and that a decree be signed, filed and entered herein accordingly upon Findings of Fact and Conclusions

of Law to be prepared and filed in accordance with Rule 42. [62]

[Title of Court and Cause No. 2616-S.]

PLAINTIFF'S OBJECTIONS AND EXCEPTIONS TO DEFENDANT'S PROPOSED FINDINGS AND CONCLUSIONS, AND PLAINTIFF'S PROPOSED FINDINGS AND CONCLUSIONS IN LIEU OF AND ADDITIONAL TO THOSE PROPOSED BY DEFENDANTS.

Plaintiff objects to the following-designated Conclusions of Law proposed by defendants' counsel and served herein on or about March 23, 1933, and requests the allowance of an exception wherever any such objection may be overruled.

I.

Plaintiff objects to proposed Conclusions of Law designated Numbers "2" to "6", inclusive, on the ground that the same are contrary to law and the evidence.

II.

Plaintiff proposes the following Findings of Facts, in addition to those proposed by defendants:

5.

That the patents in suit, and particularly the claims thereof declared upon herein, have heretofore been found valid, in a contested case tried in this Court and entitled "The Magnavox Company

vs. Frederick H. Thompson Company", decided April 9, 1930.

6.

That in said prior adjudication said patents were held to be infringed by a structure substantially similar to the structure involved herein.

7.

That the prior art relied upon herein is substantially the same as was presented in said suit of Magnavox vs. Frederick H. Thompson Company. [63]

8.

That there is no proof that any loud speaker had been conceived or constructed prior to plaintiff's Patent Number 1,266,988, embodying the combination of elements set forth in Claim 8 thereof.

9.

That the proofs show that the combination of elements specified in Claim 8 of said Patent 1,266,988 accomplished a new and useful result in respect to overcoming breakage of fine wires leading from the moving coil to the stationary binding posts, by securing said wires to the surface of the diaphragm.

10.

That there is no proof that any loud speaker had been conceived or constructed prior to plaintiff's Patent 1,448,279, embodying the combination of elements set forth in Claim 8 thereof.

11.

That the proofs show that the combination of elements specified in Claim 8 of said Patent 1,448,279 accomplished a new and useful result in respect to accurate and fine spacing of the central pole piece and circumferential pole piece and the maintenance of the moving coil in said space by affixing it to the outer pole piece and housing or sound box which supports the diaphragm to which said movable coil in turn is secured.

12.

That prior to the inventions of the patents in suit there was not in existence any commercial loud speaker of the moving coil or dynamic type.

13.

That a demand had long existed for a loud speaker of [64] the moving coil or dynamic type, because of its superiority over the iron armature type with respect to volume and faithfulness of reproduction.

14.

That the patentees of the patents in suit, through their assignee, plaintiff herein, in and by the combination set forth in the patents in suit fulfilled said demand, and the commercial devices produced thereunder were widely sold and publicly acclaimed.

15.

That in respect to the Lodge defense, the proofs show that the structures of the Lodge patent and

publications were never actually constructed or operated, except in one form which did not embody the lead-out wires secured to the diaphragm, as in Claim 8 of Patent 1,266,988, or the spacing means of Claim 8 of Patent 1,448,279; and that the only use made of said device by Lodge was in the nature of a laboratory demonstration.

16.

That none of the devices depicted in or described in the other prior patents and publications relied upon, is shown to have been put to practical or commercial use for loud speaking purposes.

17.

That the combinations covered by Claim 8 of Patent 1,266,988, and Claim 8 of Patent 1,448,279, constitute inventions.

III.

And as Conclusions of Law, plaintiff proposes the following in lieu of defendants' proposed Conclusions designated "2" to "6": [65]

2.

That Patent 1,266,988, particularly Claim 8 thereof, is valid.

3.

That Patent 1,448,279, particularly Claim 8 thereof, is valid.

4.

That the loud speakers sold by defendant Garnett Young & Company, complained of in the Bill of

Complaint herein, more particularly identified as Plaintiff's Exhibit 3, which said loud speakers are manufactured by defendant Stromberg-Carlson Telephone Manufacturing Company, constitute an infringement of Claim 8 of said Patent 1,266,988 and Claim 8 of said Patent 1,448,279.

5.

That a decree be entered as prayed, and a Master appointed to state an accounting of all damages and profits.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff.

Dated: Mar. 28/33.

Service of copy of the within Plaintiff's Objections and Exceptions to Defendants' Proposed Findings and Conclusions, and Plaintiff's Proposed Findings and Conclusions in Lieu of and Additional to Those Proposed by Defendants, admitted this 28th day of March, A. D., 1933.

JOHN N. MILLER
A. W. BOYKEN
for Defendants.

[Endorsed]: Lodged Mar. 29, 1933. [66]

[Title of Court.]

AT A STATED TERM of the Southern Division of the United States District Court for the Northern District of California, held at the Court Room thereof, in the City and County of San Francisco, on Monday, the 10th day of April, in the year of our Lord one thousand nine hundred and thirty-three.

PRESENT: the Honorable A. F. St. Sure, District Judge.

No. 2616

[Title of Cause.]

After hearing A. Dunham Owen, Esq., for plaintiff, it is Ordered that the plaintiff's objections and exceptions to defendant's proposed findings and conclusions be and the same are hereby overruled and plaintiff allowed an exception to the ruling of the Court. [67]

[Title of Court and Cause No. 2616-S.]

FINDINGS OF FACT AND CONCLUSIONS OF LAW

This cause having come on regularly to be heard upon pleadings and proof at this term of court, the parties being represented by counsel and the cause having been argued and duly submitted, upon consideration thereof the Court finds the following facts and conclusions of law.

Findings of Fact.

1.

That plaintiff, The Magnavox Company, is a corporation, organized and existing under the laws of the State of Arizona, with a place of business in the City of Oakland, State of California.

2.

That defendant Stromberg Carlson Telephone Manufacturing Company is a corporation, organized and existing under the laws of the State of New York, with a regular and established place of business in the City and County of San Francisco, State of California; that the other defendant, Garnett Young & Co., is a corporation, organized and existing under the laws of the State of California, with a place of business in the City and County of San Francisco, State of California.

3.

That plaintiff, The Magnavox Company, is the owner and holder of all right, title and interest in and to Letters Patent of the United States No. 1,266,988, dated May 21, 1918, and No. 1,448,279, dated March 13, 1923. [68]

4.

That defendant Garnett Young & Co. has sold, in San Francisco, California, and elsewhere, certain loudspeakers complained of in the bill of complaint herein and more particularly identified as Plaintiff's Exhibit 3 in the transcript of testimony, which said loudspeakers were manufactured by defendant

Stromberg Carlson Telephone Manufacturing Company.

Conclusions of Law

1.

That this court has jurisdiction of the parties hereto and the subject matter hereof.

2.

That this court finds it unnecessary to pass upon the validity of the patents in suit, limited as their interpretation must be by the state of the prior art.

3.

That the loudspeakers sold by defendant Garnett Young & Co., complained of in the bill of complaint herein and more particularly identified as Plaintiff's Exhibit 3, which said loudspeakers were manufactured by defendant Stromberg Carlson Telephone Manufacturing Company, are not an infringement of claim 8 of Patent No. 1,266,988 nor claim 8 of Patent No. 1,266,988 nor claim 8 of Patent No. 1,448,279, these being the only two claims in suit.

4.

That plaintiff, The Magnavox Company, is not entitled to the relief prayed for in its bill of complaint, or any part thereof.

5.

That the bill of complaint herein be dismissed. [69]

6.

That defendants recover from plaintiff their costs of suit.

A. F. ST. SURE
U. S. District Judge.

April 1, 1933.

Receipt of a copy of the within Findings of Fact and Conclusions of Law admitted this 23rd day of March, 1933.

TOWNSEND & LOFTUS
Attorneys for Plaintiff.

[Endorsed]: Filed Apr 1 1933 [70]

In the United States District Court for the Northern District of California, Southern Division.

In Equity No. 2616-S.

THE MAGNAVOX COMPANY, a corporation,

Plaintiff,

vs.

STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation, and GARNETT YOUNG & CO., a corporation,

Defendants.

FINAL DECREE OF DISMISSAL.

This cause came on to be heard at this term and was argued by counsel and submitted to the Court

for decision; and upon consideration thereof it was

ORDERED, ADJUDGED AND DECREED

That defendants above named, and each of them, have not infringed claim 8 of plaintiff's Patent No. 1,266,988 nor claim 8 of plaintiff's Patent No. 1,448,279, said two claims being the only claims in suit, and that the bill of complaint herein be and the same is hereby dismissed with costs to defendants taxed in the sum of $203.22.

Dated: April 1, 1933,

A. F. ST. SURE
U. S. District Judge.

Approved as to form:
CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff.

[Endorsed]: Filed and entered Apr 1 1933 [71]

[Title of Court and Cause Nos. 2615-S and 2616-S.]

STATEMENT OF EVIDENCE.

Before A. F. ST. SURE,
U. S. District Judge. Tuesday, April 5, 1932.

It was stated to the Court as agreeable to the parties to have the cases consolidated for trial; whereupon a consolidation was ordered. The two patents in suit are Pridham and Jensen Patent No. 1,266,988, Claim 8; and Pridham and Jensen Patent No. 1,448,279, Claims 8, 9 and 10 (Claims 9 and 10 subsequently withdrawn). It was further agreed

that title to these patents is in plaintiff; and plaintiff's corporate status was admitted.

(NOTE: The exhibits of both parties were formally offered in evidence and properly marked without objection unless otherwise indicated in the Statement of Evidence.)

Mr. LOFTUS: I will call Mr. Pridham. Here are drawings of the two defendants' devices in issue, your Honor. There have been filed here stipulations in each case, attached to which is a drawing exactly [74] as I have presented to the Court. It is agreed that these devices have been manufactured and sold within this district within the past six years, as alleged in the Bills of Complaint. These stipulations have been filed. I do not believe it is necessary to offer any further drawings. I offer in evidence as Plaintiff's Ex. 1, the drawing attached to the stipulation in the Ernest Ingold case. I offer in evidence, as Plf's. Ex. 2, the drawing attached to the stipulation in the Stromberg-Carlson Case. Here is the physical structure that is involved in the Stromberg-Carlson Case. I offer that in evidence as Plf's. Ex. 3. The defendant's device in the other case, in the Ingold Case, I now offer that in evidence as Plf's. Ex. 4.

TESTIMONY OF EDWIN S. PRIDHAM, A Witness on Behalf of Plaintiff.

Direct Examination by Mr. Loftus:

My name is EDWIN S. PRIDHAM. I am 50 years old and reside in Oakland, California. I am

(Testimony of Edwin S. Pridham.)

an Electrical Engineer by profession. I am the Edwin S. Pridham who is mentioned in both of the patents here in suit. I am connected with the Commercial Wireless & Development Company which is mentioned as the assignee of the first patent in suit, to-wit, 1,266,988, which patent was transferred in writing to the plaintiff here in suit. I can produce a copy of that assignment. I was also connected with the Magnavox Company, the successor of the Commercial Wireless & Development Company. The Magnavox Company assumed all right, title and interest to the patents of the Commercial Wireless & Development Company.

Q. Will you explain briefly to the Court the purpose and the operation of the device of the first patent in suit, 1,266,988?

A. In regard to this patent, especially Claim 8, which reads: [75]

"In a receiver for telephony the combination with a soundbox and its diaphragm, of a magnetic field, a vibrating conducting coil for the telephonic currents disposed in said field, and rigidly secured to the diaphragm and connections between said coil and the operating circuit comprising thin metallic strips secured to the diaphragm."

In all of our early experiments with these moving-coil instruments, we found it was very essential to wind the moving coil with a thin wire, perhaps 35 or 36 Brown & Sharp gauge. That is about the size of a horse hair. You do that in order to

(Testimony of Edwin S. Pridham.)

get a large amount of wire into this narrow area, so that the magnetic reactions will take place properly. In the demonstrations we had with this instrument, we soon found it was utterly impossible to bring out this fine wire of the movable coil to an operating circuit, because if you did that the vibrations of the coil would crystallize the wire and break it, just like anybody can take a wire in their fingers and by twisting it back and forth break the wire. This particular thing gave us a great deal of trouble in the early days of the demonstrations. We would have to have two or three instruments and throw-over switches, wherein we could put a new instrument in if one broke down. We found by a number of experiments that the way to overcome this trouble was to attach the fine wire of the coil to a stationary support which moved with the coil and then attach the operating wire, or, I might say, the wire which leads to the operating circuit, to the fine wire of the coil at this point where the fine wire was secured to the diaphragm. We did this and it solved completely the problem of breaking the wires. Practically every dynamic instrument that ever has been made since, with a few exceptions which I will enumerate later, has used this method of bringing the fine wire [76] of the movable coil out to the operating circuit. The only exception that I know of in which this is not done was an instrument in which the movable coil consisted of one single turn of heavy copper strip, which was disposed in the

(Testimony of Edwin S. Pridham.)

air gap. This single turn of heavy copper strip also formed one turn of the secondary of the induction coil. Consequently there was no need in a structure like that of attaching a fine wire to the diaphragm, the movable element, itself, was practically a bar of copper. In all instruments wherein the wire of the movable coil is a fine wire, it is absolutely necessary to attach that fine wire to some support that flexes with the coil, and then attach at that point a more flexible wire which leads to the operating circuit. In this manner we overcame all difficulty of breaking the wire in the movable coil.

(Mr. LOFTUS: I offer in evidence a copy of patent No. 1,266,988 just referred to by the witness, as Pltf's. Exh. 5. I also offer the second patent in suit, No. 1,448,279, as Pltf's. Ex. 6.)

Mr. LOFTUS: Q. Now, turn to the second patent in suit, which is marked here "Plf's Ex. 6," and explain, with reference to claims 8, 9, and 10, particularly, the purpose and operation thereof.

A. In regard to patent No. 1,448,279, this represents a moving coil type of reproducer. Claim 8, which reads upon the structures, I will describe as follows: In this structure there is a pot-shaped magnet with a core and an energizing coil on the core. This is a top plate which closes this pot. The top plate has a hole in it of sufficient diameter to take the central pole with an annular clearance around that central pole. Within the casing we have means for holding those two poles in spaced [77]

(Testimony of Edwin S. Pridham.)

relation. The diaphragm and the sound box with the coil attached to the diaphragm is arranged in that annular space between the core and the top plate, the diaphragm being mounted on a support which is attached to the top plate. Claim 9 reads just like that, with the exception that we have an insulating base for the structure. That was simply the support on which this spot-shaped magnet was held.

Claim 10 is practically the same, with a little different wording in the claims. The idea in this particular patent is to have a magnetic circuit with an annular air gap of very narrow width and minimum cross section in order to get a strong concentric magnetic field, and the idea of mounting the diaphragm with its coil in a sound box which is mounted on the top plate or outer pole of this dynamic speaker, the coil being arranged in the air gap to be freely movable. By this construction we are able to obtain a very efficient instrument. We always used an exceedingly narrow air gap so there was only two or three thousandths of an inch clearance between the coil and the pole pieces. In order to put that coil into the concentric magnetic field correctly after the pole pieces were spaced to maintain a true concentric air gap, it was necessary to so mount the diaphragm and the coil on one of those pole pieces so that the coil would move axially in the air gap with no danger of hitting either pole piece. I might say in this respect that the movable

(Testimony of Edwin S. Pridham.)

coil moves a considerable distance, from one-quarter to one-half inch in many types of instruments. When we consider that the longitudinal movement of the coil is from one-quarter to one-half inch, or .250 to .500 of an inch, and the clearance between the walls of the coil and the pole pieces is only .002 or .003 of an inch, it will be immediately [78] manifest that exceedingly great care in an instrument like this must be taken to prevent any rubbing of the coil on the pole pieces. We made these instruments in large quantity and with great success following the outlines of this patent.

Q. When you refer to a dynamic speaker, what do you mean?

A. We have always referred to a dynamic speaker as a moving coil speaker, as differentiated from a magnetic speaker. By a moving-coil speaker I mean a speaker the coil in which is attached to the telephonic circuit, is disposed to be freely movable in an intense magnetic field, so that the motion of the coil is a longitudinal motion in the air gap, that is, the coil does not approach to or recede from the pole pieces as is the case in a magnetic speaker.

Q. With respect to a dynamic and a magnetic, how do those differences manifest themselves in the matter of efficiency?

A. The dynamic speaker is a much more efficient speaker than the magnetic speaker in acoustic reproduction for this reason: It is a well-known fact

(Testimony of Edwin S. Pridham.)

in all magnetically-operated armatures that the force on the armature increases inversely as the square of the distance——

The COURT: Is there any contention upon that point, Mr. Miller?

Mr. MILLER: No, your Honor.

Mr. LOFTUS: I didn't know. I merely wanted him to explain what a dynamic speaker was in comparison to what is referred to in the depositions as a magnetic speaker.

A. In a dynamic speaker, the force is a one-to-one ratio, and moves in toward the poles or away from them, but not on the concentric air gap, which is formed by the magnetic poles. [79]

Mr. LOFTUS: Q. Now, turn to the drawing that has been marked Plf's. Ex. 1, namely, a cross-section of the Atwater Kent loudspeaker, and point out wherein you find, if at all, any or all of the elements of Claim 8 of the first patent in suit, to-wit, Plf's. Ex. 5.

A. In the cross section of the Atwater Kent loudspeaker, Plf's. Ex. 1, we find a sound-box H, with its diaphragm G, a vibrating conducting coil for telephony currents represented as J disposed in a magnetic field and rigidly secured to the diaphragm G, and connections between said coil and the operating circuit. These connections are represented by K and K′, as a conducting strip secured to the diaphragm G.

Q. Will you make that same comparison, please,

(Testimony of Edwin S. Pridham.)

with reference to Plf's. Ex. 2, that is, a cross-section of the Stromberg-Carlson loudspeaker?

A. In the Stromberg-Carlson loudspeaker, Plf's. Ex. 2, we find a receiver for telephony, a combination for a sound-box which is represented by H, and a magnetic field represented by A, a vibrating conducting coil for telephone currents represented by J. This conducting coil is rigidly connected to the diaphragm G; and connections between the coil and the operating circuit comprising thin metallic strips secured to the diaphragm. These thin metallic strips lead from the vibrating coil to a point M on the diaphragm G; from this point on M on the diaphragm G the operating wire K′ is led out to a terminal which leads to the operating circuit. These metallic strips and operating circuit wires are firmly secured to the diaphragm at the point M.

Q. Now turn to the second patent in suit, particularly with reference to Claims 8, 9, and 10, and point out wherein, if at all, you find any or all of the elements of those three claims present in the device illustrated in Plf's Ex. No. 1, Atwater Kent [80] loudspeaker.

A. As regards claim 8 of patent 1,448,279, reading the structure of the Atwater Kent loudspeaker, we have an electro-dynamic receiver comprising a shell or casing; the shell or casing in the Atwater Kent speaker is designated A. It is formed of magnetizable material; a magnetizing coil within the casing. The magnetizing coil is C, a core for

(Testimony of Edwin S. Pridham.)

the coil extending from the bottom of the casing to the top thereof. This core is represented by D, and formed at its upper end by an inner pole piece F, an outer pole piece in the form of a flat plate arranged upon the casing; the flat plate is A′ in the Atwater Kent drawing. This flat plate is arranged upon the casing and has a central opening surrounding the inner pole piece and spaced evenly therefrom; means within the casing for maintaining the pole pieces in spaced relation. These means are represented by the magnetic structure. The insulating base had absolutely nothing to do with the operation of the instrument, it was just a support for the instrument.

Claim 10 reads exactly the same way on the structure of the Atwater Kent loudspeaker.

Q. Now, turn to Plf's. Ex. 2, a drawing of the Stromberg-Carlson loudspeaker, and point out wherein, if at all, you find the elements of Claims 8, 9 and 10 of the second patent in suit?

A. Reading Claim 8 upon the diagram of the Stromberg-Carlson loudspeaker, we have an electrodynamic receiver comprising a shell or casing having bottom and side walls formed of magnetizable material; that casing, with its bottom, is A and A^2. A magnetizing coil within the casing, represented by C. A core for the coil represented by D extending from the bottom of the casing to the top thereof, and formed at the top with an inner pole piece represented by the letter F in the drawing, an outer [81]

(Testimony of Edwin S. Pridham.)

pole piece in the form of a flat plate arranged upon the casing and having a central opening surrounding the inner pole piece, and spaced evenly therefrom. That top plate is represented by A′ in the drawing. Means within the casing for maintaining said pole pieces in spaced relation. The means in the Stromberg-Carlson loudspeaker is represented by the letter E in the drawing. It consists of a brass collar which is attached to the top plate and closely surrounds the pole D in order to space the inner pole from the outer pole; a sound-box H is carried by the casing, said sound-box including a diaphragm G and a movable coil J rigidly connected to the diaphragm G and arranged within the space between the two pole pieces.

Claim 9 reads upon this structure in exactly the same way, with the exception that the insulating base is not shown.

Claim 10 also reads upon the drawing in exactly the same way.

The COURT: Q. I take it, then, that there is very little, if any, difference between Claims 8, 9, and 10 of patent 1,448,279?

A. There is very little difference, your Honor. There is a little bit of difference in the wording. For instance, in Claim 10, it says: "An electrodynamic receiver comprising a shell or casing having bottom and side walls formed of magnetizable material, a magnetizing coil within the casing, a core for said coil having contact at its lower end with the bottom

(Testimony of Edwin S. Pridham.)

of the casing, an extension on the upper end of the core forming an inner pole piece, an outer pole piece in the form of a plate removably mounted on the casing, said outer pole piece having an opening spaced circumferentially from the inner pole piece, means within the casing for retaining the pole pieces in spaced relation, a sound-box [82] arranged upon the outer pole piece and supported thereon, said sound box including a diaphragm and an annular coil rigidly connected to the diaphragm and arranged within the space between the two pole pieces." In the other one the sound-box is carried by the casing. They are practically the same in their wording except just for a little different use of English.

Cross-Examination by Mr. Miller.

Q. Please look at Claim 8 of the first patent, 1,266,988, and specify for me the mechanical elements that are mentioned in that claim. You may number them for convenience.

A. The mechanical elements named in the claim are a receiver for telephony. That is the general subject of the claim. In a receiver for telephony the combination with a sound-box—1—and its diaphragm—2; a magnetic field—3; a vibrating conducting coil for the telephonic currents—4—disposed in the field and rigidly secured to the diaphragm; and connections—5—between said coil and the operating circuit comprising thin metallic strips secured to the diaphragm—6.

(Testimony of Edwin S. Pridham.)

Q. Now, taking up the first element which you named, the sound-box, please point out in the drawings of the patent the illustration of the sound-box referred to.

A. In the drawings of the patent the sound-box is represented in Fig. 7 by the two rings which are numbered 25, which are supported upon the pole pieces numbered 12, 12.

Q. What is the form of that sound-box shown there?

A. The form of the sound-box consists of a bottom peripheral ring which is mounted by the two posts shown on the pole pieces; the top ring, which is also 25, is a peripheral ring with a cover which clamps the diaphragm between the two rings, the diaphragm in this [83] case being represented by 23. Fig. 10 shows a very good cross section of that diaphragm and sound-box.

Q. In Fig. 10 what does the numberal 26 represent?

A. 26 represents the ferrule for a horn or other listening devices.

Q. That is, a horn is supposed to be attached there when the thing is used, is it?

A. It was in this particular instance, yes.

Q. What do you consider to be the dominant element in Claim 8 which gives it patentability?

Mr. LOFTUS: I object to that, your Honor, because it is a combination claim, and you have to consider the thing in its entirety. I do not know

(Testimony of Edwin S. Pridham.)

that it is possible for any witness to pick out what the dominant element is. Furthermore, that is a matter for the Court to decide.

The COURT: I think that is so, Mr. Miller.

Mr. MILLER: In every combination there is always some dominant feature which differentiates it from the prior art. That is what I was trying to get at. I can get at it in another way.

The COURT: I will overrule the objection. You may answer.

A. I would say in this particular claim what I really think to be the prime consideration, you might say, in building a device of this kind, is to attach the fine wires of the moving coil to a stationary support on the diaphragm and then attach the operating circuit wire to that place, so the fine wire of the moving coil cannot be broken. Does that answer your question, Mr. Miller?

Mr. MILLER: Q. Yes. I presume, then, that would mean the last element specified in the claim, as follows: "And connections between said coil and the operating circuit comprising thin [84] metallic strips secured to the diaphragm." Is that the element you had in mind?

A. No, I would not say so, because in that case you do not consider the wires of the movable coil. The prime requisite, as I said before, is to be able to attach the fine wire of the movable coil to the leads which will not break when they are vibrated. In the combination there is this, if I may state it:

(Testimony of Edwin S. Pridham.)

The connections between the coil and the operating circuit comprising thin metallic strips secured to the diaphragm in this regard, that the wire of the movable coil is attached to the diaphragm and also these thin metallic conduction strips are attached to the diaphragm.

Q. The claim does not describe that arrangement, as I read it, but simply specifies the thin metallic strips secured by the diaphragm; isn't that so?

A. No, it does not. It says: "In a receiver for telephony the combination with a sound-box and its diaphragm, of a magnetic field, a vibrating conducting coil for the telephonic currents disposed in said field, and rigidly secured to the diaphragm."

Q. I want to find out, if I can, what this claim means. The only way I can do that is to read the words of the claim and then ask you about them. I find in the claim these words: "And connections between said coil and the operating circuit comprising thin metallic strips secured to the diaphragm." That is true, is it not, as far as that claim is concerned?

A. Yes.

Q. Point out to me in the drawing those thin metallic strips.

A. The thin metallic strips which are secured to the diaphragm are clearly shown in Fig. 10 of the patent. They are numbered 27 in this particular drawing. They are attached to the thin wire of the movable coil very close to the center of the dia-

(Testimony of Edwin S. Pridham.)

phragm. They lead out to the operating binding post which is [85] numbered 29 in that drawing. The thin metallic strip which is represented by 27 is not the same wire that the coil is wound with. It is a flexible wire. The coil is wound with a thin No. 35 or 36 Brown & Sharp gage wire. It is shown there as a flat metallic strip or ribbon, marked 27 and it extends out very nearly to the periphery of the diaphragm. It is attached at the center of the diaphragm, on the under side. There is a distinct air space shown between the diaphragm and the metallic strip, which is bent as shown by the shading in Fig. 9.

In Fig. 9 the strips are secured to the diaphragm contacting with the fine wires of the coil at a point represented at about 24. They are led out across the diaphragm. In the case of Fig. 9, they are attached to the diaphragm about half way out and then are bent down and are connected to the operating binding posts which may be represented by 29 in that drawing.

Q. I have an enlarged reproduction of Fig. 9; just compare that and see if that is correct.

A. Yes, that is correct.

Q. I understand that before you got up this device with these flat mechanical strips you used just the conventional round wire?

A. No, we used the wire the core was wound with and we led that right onto a circuit.

Q. What was the size of that wire?

(Testimony of Edwin S. Pridham.)

A. About 35 or 36. That would crystallize by the vibration, that is, bending back and forth, because the coil vibrates very rapidly and, of course, one end being anchored and the other end moving, the coil would crystallize.

Q. And when you supplied the wire in flat metallic strips, that difficulty was obviated?

A. Yes, but it was not obviated by simply using the flat metallic strips. That is not the essence of the invention, at all.

Q. I am just taking the wording of the claim, itself. That is the only thing I can go by. If you have some secret idea in your own mind that is not expressed in that Claim I am [86] not concerned with that.

A. No, I have not.

Q. Here is a model of the Atwater Kent machine, Plf's. Ex. 4; will you please point out in this model the flat metallic strips referred to in their claim?

A. These are the thin metallic strips secured to the diaphragm. This is a flexible wire. That is not the wire that the movable coil is wound with. The wire that the movable coil is wound with is a very thin 35 or 36 wire, a round solid wire. You can see that down in the center, there, it is attached to the coil. This wire that appears underneath the paste there is the thin metallic strip.

Q. A round wire?

A. Yes, but it is a thin metallic strip, isn't it?

(Testimony of Edwin S. Pridham.)

Q. This device that is pasted down onto the diaphragm by means of some paste there is in form a round wire, is it not?

A. A round flexible wire, yes.

Q. I understand your position to be that as shown in this model, Plf's. Ex. 4, that round wire that appears there pasted onto the diaphragm is the element called for by this claim 8?

A. Yes, that is correct.

Q. And that is your position in this case, is it?

A. That is my position, yes.

Q. Now, taking up the second patent in suit, 1,488,279, will you please catalog for me for the purpose of convenience the elements of that claim.

A. An electrodynamic receiver comprising a shell or casing—we will call that shell or casing No. 1; a magnetizing coil within the casing—we will call that No. 2.

Q. Are you reading from Claim 8?

A. Claim 8 and referring to Fig. 2. An electrodynamic receiver comprising a [87] shell or casing having bottom and side walls——

Q. The shell or casing was No. 1?

A. Yes.

Q. Now No. 2.

A. A magnetizing coil within said casing. We will call that No. 2. A core for the coil extending from the bottom of the casing to the top thereof; we will call that No. 3. And formed at its upper end with an inner pole piece—No. 4, an outer pole

(Testimony of Edwin S. Pridham.)

piece appears in the form of a flat plate—No. 5—arranged upon the casing, and having a central opening surrounding the inner pole piece and spaced evenly therefrom; means within the casing for retaining said pole pieces in spaced relation—No. 6; a sound-box, No. 7; said sound-box including a diaphragm—No. 8—and a movable coil, No. 9, rigidly connected to the diaphragm and arranged within the space between the two poles.

Mr. MILLER: Q. Now, looking at the drawings of the patent, what is the shell or casing having a bottom and side walls formed of a magnetizing casing designated what?

A. No. 14 in the drawing Fig. 2.

Q. That is simply the pot which contains a magnet?

A. That is correct.

Q. And these magnets have the technical name of pot-shaped magnets, haven't they?

A. They are so-called in the trade.

Q. The second element you gave was a magnetizing coil within said casing. What is that designated by?

A. That is designated by the figure 16 in drawing 2.

Q. That is just simply the winding on the magnet?

A. That is the winding on the magnet, yes.

Q. A core for the coil, extending from the bottom of the casing to the top thereof and formed at its

(Testimony of Edwin S. Pridham.)

upper end with an [88] inner pole piece: What is that designated as?

A. That is No. 17, the core formed at its upper end with an inner pole piece, No. 12.

Q. That inner pole piece 12 is not integral with the core 17, is it?

A. In this particular drawing it is not.

Mr. MILLER: Q. How is that inner pole piece 12 formed or constructed?

A. The inner pole piece is formed by a short piece of magnetic material which when in place is in intimate contact with the central pole 17.

Q. I will read to you from line 86, page 1, of the specifications: "The iron core 17 of the magnetizing coil 16 is bored out to form a seat for the pole piece 12 so as to make a good magnetic contact." That is correct, is it?

A. That is correct as referring to Fig. 2.

Q. That Fig. 2 is attached in some way to the receiver head so that when the receiver head is removed it will go with the receiver head, will it not?

A. That is correct.

Q. I show you a reproduction of your drawing but arranged in a little different way. In this drawing I have removed the receiver head from the magnetizing structure, as the patent says it can be done. This drawing that I show you will represent that, will it?

A. This drawing appears to be correct as regards Fig. 2 of the patent, with the top plate and

(Testimony of Edwin S. Pridham.)

small core 12 attached in the spacing ring or held in the spacing ring.

Q. I show you another one of these drawings, which I have colored up so as to make it more striking.

A. Yes, that is correct as regards Fig. 2.

Q. You do not find in the Atwater Kent structure the movable inner pole piece 12 which is detachable from the core here, do you?

A. I do not find any short piece in the Atwater [89] Kent so it can be removed as a unit, no.

Q. In the Atwater Kent the core of the magnet which extends all the way from the bottom to the top is all in one piece, is it not?

A. Yes, that is correct. In the Atwater Kent drawing here the core D which is held in the space ring E could be removed by removing the screw at the bottom and pulling it out. What you are asking me is if this small pole piece marked F at the top of the Atwater Kent, if that comes off the part marked D?

Q. Yes.

A. No, it does not.

Q. Is there any advantage in having that detachable pole piece 12 which is shown in your patent?

A. Sometimes there is, sometimes there is not in manufacturing. It all depends upon the way it is manufactured. We made a great many instruments like it, and we made thousands without the pole tip removable like that.

(Testimony of Edwin S. Pridham.)

Q. You do not use the removable pole of that type now, do you?

A. Yes, we do in many instances; we use them in electrodynamic speakers in marine telephone work.

Q. What is the object in removing that?

A. If the magnetic structure becomes very small, like in the present structures, it may be only an inch or two long, that pole piece is removed [90] right with the head; in the old type, where you had a very long piece, for instance, six inches, it was necessary to bore out the long magnetic pole and insert a small one.

Q. That magnetic piece, then, is of some convenience, is it, in some instances?

A. Oh, yes, indeed, it is.

Q. Will you please point out in the drawing of the Atwater Kent machine which you have there what you call the sound-box and diaphragm?

A. In the drawing of the Atwater Kent loudspeaker the sound-box H and the diaphragm G is what I term the sound-box and diaphragm.

Q. And that is represented in the model by this framework?

A. By this framework and the diaphragm with the supporting rings which hold it in place.

Q. In other words, this cover which we find here, this cover or framework which we find here is the mechanical equivalent, as you understand it, of the sound-box shown specifically in your pattern?

A. Yes.

(Testimony of Edwin S. Pridham.)

Q. Of course, the Atwater Kent does not show the form of sound-box shown in your patent?

A. No.

Q. It does not show a box-like structure?

A. It shows supporting means for the diaphragm with a cover on the front.

Q. In your patent you have a box-like structure, have you not?

A. There is nothing in the back of it; it is completely open in the back. There is a front on the supporting ring which will take a horn.

Q. Now tell me about that horn. Why do you want to use a horn?

A. You want to use a horn so you can use a loudspeaker in the old days. When the diaphragm vibrated it was necessary to place the air of the room above atmospheric pressure and to direct the sound through a trumpet or a horn. [91]

Q. When you were exploiting your first patent, that is, selling the devices, and I am referring to patent 1,266,988, you used a horn with it, did you?

A. Yes, we did.

Q. Up to what time did you use the horn?

A. With that particular instrument?

Q. Yes.

A. Until about 1920. I imagine.

Q. After you discarded the horn or discontinued the horn, what did you supply in its place?

A. After we discarded the horn on that particular instrument, we did not make that mechanical form of instrument except as regards Claim 8 of the

(Testimony of Edwin S. Pridham.)

patent, the leadout strips of wire. We did not make the mechanical form of the instrument after 1920.

Q. What did you make after 1920?

A. We made after 1920 the device as exemplified in the next patent, to wit, 1,488,279, which shows a ferrule on the sound-box on which we placed a horn at that time.

Q. How long did you use that device with the horn?

A. We use it still. That device is still used and quite a number are sold at the present time with the horns, exponential horns, as they call them, for talking motion picture work.

Q. That is for some particular use, is it not, and not for general use?

A. It is for commercial use with motion picture houses. We sell them and get money for them. There is quite a trade in that particular type of instrument.

Q. In your commercial style of device you do not use that now, do you?

A. We sell them in commerce and bill the customer for them and get money for them. That is commercial, isn't it? Do you mean—I don't know what you mean, Mr. Miller?

The COURT: Q. What is your principal business?

A. The principal business is selling these loudspeakers to radio concerns [92] that do not use

(Testimony of Edwin S. Pridham.)

a horn. That is our principal business. However, we sell quite a number of horns.

Mr. MILLER: Q. With that business, then, your principal loudspeaker business, you do not have horns any longer?

A. That is correct. I just wanted to make it clear that the horn is not obsolete in commercial work; that is not true.

Q. I am going to show a device and ask you if you recognize it.

A. I do recognize it very well. I imagine it is a Magnavox loudspeaker made from 1920 to 1922. It is a very old type one. I would say that that particular instrument was made under the 1,266,988 patent. We made that from 1922, say, or 1921, to 1928 or 1929. We may be making some like that right now for export purposes.

(Mr. MILLER: I would like to have it marked Defs'. Ex. A for identification.)

Q. Now, I show you another loudspeaker and ask you if you recognize that.

A. That is a modern type of Magnavox loudspeaker made by the Magnavox Company. It has the nameplate of the Magnavox Company on it. We commenced to manufacture the cone type of loudspeaker in the fall of 1926 and the spring of 1927 and we have been selling them ever since.

Q. Where is the sound-box in this device that we have just been referring to?

A. The sound-box, as I have mentioned, is the

(Testimony of Edwin S. Pridham.)

cone housing with the peripheral supporting rings and the diaphragm. There is a ring underneath here which holds the periphery of the diaphragm in place. It consists of the housing and the diaphragm.

Q. Substantially the same in mechanical construction, though a little different in form, as the cone housing in the [93] Atwater Kent?

A. Yes, very similar.

Q. What kind of a diaphragm do you have in this device?

A. That is a cone-shaped diaphragm, well-known in the art.

Q. How long has it been well-known in the art?

A. Since 1907, I imagine.

Q. It is made of paper, is it not, or some material of that kind?

A. Yes, made of a peculiar impregnated paper, rubber impregnated paper called Lexide, I believe.

Q. You have discontinued using that metallic diaphragm and substituted for it this paper cone, have you not?

A. We have [94] not discontinued using the metallic diaphragm, because we still sell some of those metallic diaphragm instruments for use with horns. The greater majority of them, however, are made with the paper cone diaphragm.

Q. The principal part of your commercial business for radio loudspeakers is such as is shown by the paper diaphragm and cone support?

(Testimony of Edwin S. Pridham.)

A. Yes, that is correct.

Q. You have sold large quantities of these, have you?

A. Yes.

Q. And you say you commenced selling them in about 1926 or 1927?

A. The fall of 1926 and the spring of 1927. I think any commercial quantities began with the spring of 1927.

Q. Do you find this paper cone more advantageous than the circular metal diaphragm that you used before?

A. No, not at all. The circular metal diaphragm is, if anything, superior to the cone when used with the proper horn.

Q. You do not use this device with a horn, at all, do you?

A. Yes, we sell a great many of those with horns.

Q. I understand, then, that you discarded the superior device, consisting of the circular metal diaphragm, and began to use the inferior device—that is, not as superior as the diaphragm—consisting of a paper cone? Do you want to appear that way in Court?

A. I would like to appear that way in Court, yes, indeed, with this interpretation as regards inferior and superior, that is, that it depends upon the use to which you put it. If you put an instrument to use in talking motion pictures you use a light metallic diaphragm with an exponential horn.

(Testimony of Edwin S. Pridham.)

Very large quantities of those are sold today. If you want to have a much cheaper instrument which will fit in in homes and be readily adapted to a radio cabinet, you use a cone loudspeaker, because the expense is very much less and the convenience to the users is [95] very much greater. However, so far as the efficiency of the loudspeaker goes, there is nothing so far that will equal the thin metallic diaphragm with the exponential horn. That is proved by the very large quantities that are sold today by the Western Electric, the Radio Corporation, and by those large companies. I just wanted to bring that out to show you that it is not a question of inferiority or of superiority, it depends upon the place you wish to use it.

Q. Where did you get the idea of using this paper cone and this cone support that is shown in this device?

A. We were making for many years cone magnetic speakers, and we simply adopted the dynamic drive to the paper cone, which we were using in magnetic speakers to the dynamic speakers.

Q. When did you first use anything in magnetic speakers?

A. We used cones in magnetic speakers in 1923, 1924, and 1925, and along there; from 1923 to 1925 and forward we used cones in magnetic speakers.

(Mr. MILLER: I ask that this be marked Defs' Ex B for identification.)

Q. You spoke something of an exponential horn.

(Testimony of Edwin S. Pridham.)

Will you please tell me what that is, and give me the dimensions of it?

A. An exponential horn may have any dimensions whatsoever. It relates entirely to the ratio of the opening at the end of the horn to the taper of the horn. In most exponential horns, for instance, where you want to obtain very efficient response, the opening at the outer end is rather large; it may be two or three feet in diameter. It must have a very slight taper. It follows what we call the exponential formula in mathematics; it is the ratio of the taper or incline of the horn between the apex of the horn and the mouth of the horn. It has been proven to be the [96] correct type of horn to use to reproduce in all clarity the different frequencies in sounds, from the lowest bass to the highest treble.

Q. What are the exponential horns used for?

A. The exponential horns have been used for the radio. A great many of them were sold in 1928. Another name for them is air column horns. They are still on the market today. Westinghouse puts out an exponential horn. Crosley puts out an exponential horn.

Q. What are the dimensions of the average exponential horn used today?

A. About six feet long, I imagine, and maybe a foot and a half to two feet in diameter. They are used in the new type of radios which are coming into very great use in the form of grandfather

(Testimony of Edwin S. Pridham.)

clocks. The radio instrument is up near the clock, and the horn goes down through the grandfather clock base. It produces very fine results that way.

Q. In discussing the claims of your patent 1,448,279, when referring to claims 8, 9, and 10, you said that it was very essential to the correct operation of such a device that there should be a narrow air gap, did you?

A. Yes.

Q. Please point out in the specification anything in the patent there is in regard to a narrow air gap, anything that the patent says in regard to a narrow air gap.

A. Reading from page 1, line 94: "We have found that the greater the density of magnetic flux in the air gap, the greater the efficiency of the instrument. Therefore, the instrument must be designed so as to utilize to the highest degree the magnetic flux of the magnetic structure. For this reason it will be apparent that the cross section of the air gap must not be greater than the cross section of the central pole. Thus the depth of the air gap for maximum efficiency can not be more than one quarter of the diameter of the center pole, [97] as the area of the cylinder equals the cross section of the cylinder when the altitude of the cylinder is equal to one-fourth its diameter".

Q. Is that the only part of the specification that refers to a narrow air gap?

A. I think there is another part here; I will look it over. I am reading from line 18, page 2: "We have made certain mechanical improvements in the receiver which have aided greatly in the construction of the instrument. As mentioned above, the

(Testimony of Edwin S. Pridham.)

flux density should be as great as possible, so for this reason the width of the air gap should be kept a minimum just sufficient to admit the moving annular coil with a few thousandths of an inch clearance on either side."

That certainly means a narrow air gap.

The COURT: Q. What are you reading from?

A. From page 2, starting line 18 of the specification: "As mentioned above, the flux density should be as great as possible, so for this reason the width of the air gap should be kept a minimum just sufficient to admit the moving annular coil with a few thousandths of an inch clearance on either side." That certainly refers to a narrow air gap.

Mr. MILLER: Q. You have now pointed out all the parts of the specifications referring to the question under discussion, have you?

A. I am not sure, because I think all the way through it mentions that. I think that is sufficient, though, to point it out. I can not find anything else in there.

Q. As I understand you, you said that the only difference between Claim 8 and Claim 9 of this patent resides in the fact that Claim 9, in addition to the element called for by Claim 8, also calls for a base of insulating material; is that true?

A. There must be other differences or the Patent Office would not have [98] allowed any differentiation. You simply could not repeat a claim and get it allowed. I am sure there are specific differences.

(Testimony of Edwin S. Pridham.)

Q. In other words, in Claim 9 the electrical device or whatever it is is placed on a base of wood to hold it?

A. That is correct, anything to hold the instrument. The base has nothing to do with the technical operation of the instrument. It is simply as if you placed this receiver on this desk, the desk would have nothing to do with the operation of it.

Q. You said you thought that Claim 10 was practically the same as the other claims, that is, Claims 9 and 8, except for a little change in phraseology; that is your idea of the claim, is it?

A. Yes.

Q. So that Claim 8 would practically cover all that you wanted as an effective implement and Claims 9 and 10 might just as well have been left out?

A. Well, I am not so sure that they might just as well have been left out, but I will say this, that Claim 8 covers the elements of the instrument very well.

Mr. MILLER: That is all.

Mr. LOFTUS: I have here, your Honor, a photostat of the assignment from the Commercial Wireless & Development Company to the plaintiff, the Magnavox Company.

Mr. MILLER: It appears by the document just handed to me by counsel that on August 17, 1917, the Commercial Wireless & [99] Development Company by its proper officers assigned to the Magnavox Company, the plaintiff herein, the invention

(Testimony of Edwin S. Pridham.)

described in patent No. 1,266,988, and that the Magnavox Company is still the owner of that patent. I am willing to concede that, your Honor, so as to save the necessity of putting this document in evidence.

Redirect Examination by Mr. Loftus.

Q. In your cross-examination, Mr. Pridham, in analyzing the elements of Claim 8 of Patent No. 1,488,279, you applied No. 4 to that portion of the claim reading "And formed at its upper end with an inner pole piece"; did you intend by that that that was to be considered as a separate element in itself?

Mr. MILLER: I object to that question, your Honor, that is calling for an opinion, what his intent was.

Mr. LOFTUS: It is merely to explain his answer.

The COURT: Objection overruled.

A. In reading over Claim 8 it will be noticed that it contains "a core for the coil extending from the bottom of the casing to the top thereof, and formed at its upper end with an inner pole piece." That was to distinguish from the other claim, 10, in which it says, "A core for the said coil having contact at its lower end with the bottom of the casing and an extension on the upper end of the core forming an inner pole piece." In one case the core is formed with the inner pole piece as an integral part of the core. In the second

(Testimony of Edwin S. Pridham.)

case there is an extension on the upper end of the core which forms the inner pole piece.

The COURT: Q. Do you wish to make any change in the elements you mentioned?

A. Yes, I would like to make this change: In my original testimony I called that inner pole piece 4 and I would [100] like to change it to 3^a.

Q. Now you are referring to patent 1,448,279?

A. Yes, your Honor, and to the eighth claim.

Q. And you want to call that 3^a?

A. Yes, instead of 4.

Mr. LOFTUS: Q. Now, in regard to the element in Claim 9, namely, a base of insulating material, is that shown in the drawing of the patent, and if so, point it out?

A. It is shown in the drawing of the patent, Fig. 2, as the cross hatched black area at the bottom of the magnetic casing.

Mr. LOFTUS: That is all. [101]

The COURT: Mr. Loftus suggests that he might withdraw claims 9 and 10. Is that correct?

Mr. LOFTUS: Yes. There is no reason why we should stand on them. I think our rights are covered by Claim 8.

The COURT: Then it is understood that Claims 9 and 10 are withdrawn?

Mr. MILLER: Very well.

Mr. LOFTUS: That is true.

Mr. MILLER: I offer in evidence Defs' Ex. B for identification. I offer in evidence:

As Defs'. Ex. C, Bell Patent 186,787, Jan. 30, 1877;

(Testimony of Edwin S. Pridham.)

As Defs'. Ex. D, Siemens Patent 149,797, Apr. 14, 1874;

As Defs'. Ex. E, British Patent to Siemens, 4685, of 1877;

As Defs'. Ex. F, Cuttriss and Redding Patent 242,816, of June 14, 1881;

As Defs'. Ex. G, Cuttriss and Milliken Patent 256,795, Apr. 18, 1882;

As Defs'. Ex. H, Milliken Patent 262,811, Aug. 15, 1882;

As Defs'. Ex. I, Mather Patent 387,310, August 7, 1888:

As Defs'. Ex. J, a patent issued to Sir Oliver Lodge, No. 9,712, of April 27, 1898;

I offer in evidence as Defs'. Ex. K, a copy of a printed publication entitled "The Electrician," of Jan. 6, 1899, being pages 366 and 367. I will produce an enlargement of that figure, made in colors, and ask to have that marked "Defs'. Ex. L."

Mr. LOFTUS: I might as well object to that at this time, your Honor, because it is not a true enlargement. There is a lot of handwork on there.

Mr. MILLER: I am going to explain that.

The COURT: Then let it go in as a part of your argument. Exhibit L goes in then as part of your argument. Let it be so marked.

Mr. MILLER: I will next offer in evidence, as Defs'. Ex. M, an uncolored enlargement of that Fig. 5. [102]

Mr. LOFTUS: There is no objection to that. We

(Testimony of Edwin S. Pridham.)

have had that before in all of the cases. That is a mechanical enlargement.

Mr. MILLER: I will offer as Defs'. Ex. N, a publication from "Electrical Engineer," Vol. 27, No. 565, pages 246 and 247.

I next offer in evidence:

As Defs'. Ex. O, Pearson Patent 903,745, Nov. 10, 1908;

As Defs'. Ex. P, Pollak Patent 939,625, Nov. 9, 1909;

As Defs'. Ex. Q, French Patent to Oliver, 404,286, of Nov. 27, 1909;

As Defs'. Ex. R, British Patent to Oliver, 12,857, of 1909;

As Defs'. Ex. S, Oliver Patent 951,695, of March 8, 1910;

As Defs'. Ex. T, Johnsen Patent 1,075,786;

As Defs'. Ex. U, Hopkins Patent 1,271,529, July 2, 1918;

I next offer in evidence Patent 1,847,935, to Farrand, application filed April 23, 1921 and patent issued March 1, 1932.

Mr. LOFTUS: We object to that, your Honor, because it is not set up in the Answer, and no notice was given; also because it is much later than either of the patents in suit.

Mr. MILLER: It does not have to be set up in the Answer, because I am not using it for anticipation. So that objection will have to go out.

Mr. LOFTUS: Then why offer it? I think the objection is good.

(Testimony of Edwin S. Pridham.)

The COURT: Yes, I think the objection is good.

Mr. MILLER: I will withdraw that offer for the time being, until I read the deposition of Mr. Farrand.

I offer in evidence the French Patent to Ragonot, No. 570,746.

Mr. LOFTUS: The same objection applies to that, your [103] Honor. You will note the patent bears date of 1924, which is later than either of the patents in suit here. There has been no notice given with respect to this particular patent.

Mr. MILLER: I am offering it for the purpose of showing there is a difference between a cone device and a sound-box device. That is the purpose for which I am offering it; that they are two different things, and therefore they cannot be equivalents.

Mr. LOFTUS: It is a mere argument, your Honor.

The COURT: Yes, it is mere argument, Mr. Miller. The objection is sustained.

Mr. MILLER: I note an exception.

The COURT: I don't know whether it has been stated that the patent was issued May 6, 1924? I want the record to show it.

Mr. MILLER: I offer in evidence:

As Defs'. Ex. V, the British patent to Edison, No. 2909, of 1877;

As Defs'. Ex. W, the American patent to Edison, No. 203,015, of April 30, 1878;

(Testimony of Edwin S. Pridham.)

As Defs'. Ex. X, Rogers Patent 297,168, Apr. 22, 1884;

As Defs'. Ex. Y, Richards Patent 521,220, June 12, 1894;

As Defs'. Ex. Z, Shreeve Patent 602,174, Apr. 12, 1898.

I will now call Judge Fouts to the stand. [104]

TESTIMONY OF SAMUEL E. FOUTS,

a witness on behalf of Defendant.

Mr. MILLER: Q. Please state your qualifications, Judge Fouts, in patent mechanical matters.

The COURT: I suppose they will be admitted?

Mr. LOFTUS: I will concede that Mr. Fouts was an Examiner in the Patent Office. That is all I know about his qualifications.

Mr. MILLER: He was the presiding judge in the Patent Office which passed on appeal matters.

Mr. LOFTUS: They have no judges in the Patent Office, as I understand it. They are all examiners.

The COURT: All right, proceed.

Mr. MILLER: Q. Have you made a study of this art as it refers to the claims in question?

A. I have. Your Honor, I think Mr. Loftus made the remark that, as far as he knew, there are no judges in the patent office, that they are all examiners. I think that that ought to be cleared up.

(Testimony of Samuel E. Fouts.)

The COURT: What is it you wish to say in reply to that suggestion?

A. We have in the Patent Office what is known as an examining corps, which is made up of a large body of examiners of various grades. They do the examining work. If the examiners refuse to allow patents, and also in cases of interference, these matters may be appealed from the examiner to the board, which is called a Board of Examiners in Chief, which is analogous to a court, and I was a member of that Board of Appeals for practically ten years. They are not considered examiners, they are an appellate board.

Mr. MILLER: Q. Please look at the patent to Alexander Graham Bell, which is Defs' Ex. C, and just state briefly what there is in that patent shown relevant to any point here in issue. I don't want you to go over the patent. I want you to be very [105] brief and just point out those things.

A. That patent shows the early type of telephone receiver. It comprises a sound box, with a diaphragm, which is clamped about its edges in the sound box, and is set in vibration by electric currents which pass around the magnet F through the coil G. The vibration of the diaphragm sets up waves of compression in the sound box which pass out through the tube E to the listener, or it can be used as a transmitter by talking into the tube E. The coil G is in the electric circuit leading off to the line wire shown in Fig. 4 of the patent.

(Testimony of Samuel E. Fouts.)

Any sound waves impressed upon the diaphragm in one instrument will cause pulsations in that electric circuit and will set up corresponding vibrations in the diaphragm of another instrument on the same line.

Q. Please look at Defs' Ex. D, which is a patent to Siemens, No. 149,797, of April 14, 1874, and just state very briefly what there is shown in that patent that is relevant to any issue in this case?

A. The patent discloses what is called a magneto electric apparatus. It comprises a magnet which the patent says, near the bottom of the first column of the specifications, may be either a permanent or an electromagnet. One of the poles of the magnet is cylindrical. It is surrounded by the outer pole piece, leaving between these pole pieces a magnetic gap which is annular. I would like to direct attention to the fact that Mr. Siemens refers to this magnetic gap as a narrow space. He even goes so far as to state that it is a very narrow intervening space. You will find that in the second paragraph of the specifications. So within this very narrow intervening space Mr. Siemens mounts his annular dynamic coil, which I believe is shown by the small letter c. That coil is suspended on wires, A—— [106]

A. I will try and be brief about it. Those wires, A, are vibrated by the coil as it moves up and down in this narrow air gap. In a way, they have the same movement that a diaphragm would have if the coil were attached to a diaphragm.

(Testimony of Samuel E. Fouts.)

Mr. MILLER: Q. Please refer to Siemens' British patent 4685, being Defs'. Ex. E in this case, and just briefly say what Figs. 5 and 6 are.

A. They show telephone structures. Take Fig. 5, there is a diaphragm to which is connected the annular coil which works up and down in the air gap between the inner and the outer pole pieces. The diaphragm is clamped about its edges in the sound box. Fig. 6 shows generally the same arrangement, except that instead of having the ordinary diaphragm as in Fig. 5, the annular coil is connected to what is referred to as a membrane of parchment or other material of trumpet form, to increase the effect of the sound pulses.

The COURT: Q. Is that mentioned in the specifications?

A. Yes, it is; on page 4, beginning with line 50. I might [107] call attention to the fact that in Fig. 6 the whole structure is encased in what appears to be a solid block of material there, so that it would be quite impossible, in such a structure, for there to be any displacement of one pole within the other. There are means shown there for maintaining the proper spacing of the pole pieces.

Mr. MILLER: Q. Now look at Exhibit F, patent to Cuttriss and Redding, No. 242,816, of June 14, 1881, and state briefly what you find in there illustrated as material to anything in this case.

A. That is also a telephone. It has the magnet with a cylindrical center pole piece surrounded by

(Testimony of Samuel E. Fouts.)

the outer pole piece, which is of annular form, and which is shown specifically in Fig. 3. That leaves an annular air gap between these two pole pieces and within that air gap vibrates the annular coil C, which is connected at the center of the diaphragm D. The diaphragm is clamped in the sound box F. Of course, the vibrating coil is connected to the stationary lining posts L and G through flexible connections which have pigtail twists in them so as to permit the vibration of the coil without great interference.

Q. Take Defs' Ex. G, patent to Cuttriss and Milliken, 256,795, and state briefly what you find there relative to any issue in this case.

A. I find in that patent a telephonic receiver which has the magnet with the poles arranged in the same manner as in the patent I have just discussed, so as to provide an annular air gap within which vibrates the annular coil I. In this case that coil is connected to a rather narrow plate A, which extends across the sound box. That plate is connected to the diaphragm proper, B, through a pair of wires which extend out, as shown in Fig. 3, and frictionally engage with a small aperture in the diaphragm B; so as the plate A vibrates it transmits its vibrations [108] to the diaphragm through the frictional connection shown in Fig. 3.

Q. Take Defs' Ex. H, patent to Milliken, 262,-811, of August 15, 1882, and state briefly what you find there shown relative to any matter in this case?

(Testimony of Samuel E. Fouts.)

A. In the Milliken patent you have a magnetic structure which approximates the pot structure, that is, you have a series of horseshoe magnets having their north poles all brought together in a bundle in the middle, and the south poles arranged around this middle bundle in a circle. Then to hold all these poles in their proper position, Milliken uses this member *b,* which is some sort of insulating material, he calls it a block *b* of hard rubber or other suitable non-magnetic material. That is on page 1, line 61. So the poles are held in their proper positions, maintaining the annular air gap by this block of insulating material. The diaphragm is vibrated, of course, by the movement of the coil, and the diaphragm is clamped within the sound box.

Q. Take Defs' Ex. I, patent to Mather, 387,310, of August 7, 1888, and state briefly what there is shown in that patent relevant to anything here?

A. That is a device for producing a mechanical movement by electrodynamic means similar to those we have been talking about. In Fig. I there is the true pot member, having the inner core 2, and the outer walls forming a cylindrical vessel or chamber; within this chamber about the inner pole is wound the magnetizing coil 3. The cover of the pot forms the outer pole piece; it has a central aperture into which projects the upper end of the core 2, being spaced from it to form an annular air gap. The vibratory coil 6 works up and down in

(Testimony of Samuel E. Fouts.)

this air gap. In this particular disclosure it operates a sort of walking beam 8, which is pivoted on the support 9 on the outer [109] pole piece. There is a weight 11 hung from the outer end of this walking beam. Weight 11 merely represents the work or the load which the device is lifting up and letting down again.

Q. Do you find in this patent anything in the nature of a spacing ring or device?

A. Yes. The magnetizing coil 3 is wound upon a spool which is said to be of brass or some such material. The spool is made of such size as completely to span the space between the inner pole piece and the inner wall of the pot. That would hold the inner core centralized within the pot.

Q. Look at British patent to Lodge, 9712, of 1898, being Defs' Ex. J, and state briefly what you find in the Lodge patent relative to anything in this case?

A. Lodge shows a number of specific types of receivers. He was interested in what he refers to or has referred to as space telegraphy. This is akin to the modern radio. In Fig. 1 he shows a sounding board *d,* which is set in vibration by an electrodynamic coil which is lettered a, and which works in an annular gap between the pole pieces. Fig. 1 does not show that magnetic structure so very well, but it is shown in Figs. 2 and 3 and other of the figures. The center pole *c'* projects into an aperture in the outer pole so as to form

(Testimony of Samuel E. Fouts.)

an annular air space in which the annular coil *a* vibrates. On Fig. 1, as I have said, that movement of the coil operates the sound board *d*. In Fig. 2 it operates a sort of a microphone which is supported upon a tuning fork or structure of that nature. In Fig. 3 the coil also operates a sort of a microphone, one part of which is carried by a spring *b*, and the other by the bracket *j*, the upper part of the microphone being designated *h*, which can be adjusted towards and from the microphone element on the spring. Figs. 5 and 5[a], etc., show practically the same thing. All of these figures that I have referred to [110] maintain the two pole pieces in their proper spaced relation by the use of a plate designated *f*.

The COURT: Q. In what figure?

A. You see that in Fig. 1 and Fig. 2 and Fig. 3.

Q. By the letter *f*?

A. Yes, the letter *f*.

Mr. MILLER: Q. I think that is shown in Fig. 5, isn't it?

A. It is shown in Fig. 5-C—perhaps it is not shown there best. Well, you can see it very clearly in Fig. 3. In this little blue book a portion of Fig. 5 is shown where the brass plate is designated *f*. That is a spacing plate which is secured to the outer pole piece and closely embraces the inner pole piece so as to maintain these pieces in proper spaced relation and so maintain the air gap. In Fig. 6 Sir Oliver Lodge has shown several differ-

(Testimony of Samuel E. Fouts.)

Q. Do you know how it should be constructed?

A. Yes.

Q. Is there sufficient data appearing on the face of the figure, itself, to enable a person skilled in the art to construct it?

A. I should say there is. Those devices just under the plate E [112] at the top, called three supports, might be a little difficult to locate exactly, but the specification says they are put at the nodal line and I guess that could be determined.

Q. Is the device which is shown in this little blue book of mine underneath the title Fig. 5 of the Lodge article, will you just look at that device and state whether that is a faithful reproduction of the Fig. 5 which we have just been considering?

A. Yes, it is.

Q. Do you find any spacing device there for the poles?

A. Yes, upper head of the spool upon which the magnetizing coil is wound certainly is shown extending the entire space between the inner pole and the cylindrical shell.

Q. Would that have the effect of spacing those pole pieces?

A. Undoubtedly it would hold the inner core in a central position within the shell. Then the outer pole piece is set down within that shell so there could not be any relative movement between the two pole pieces, and it would maintain the pole pieces spaced.

(Testimony of Samuel E. Fouts.)

Q. Now, will you please look at the Johnsen patent, 1,075,786, and the British patent 12,141, of 1911, and just explain briefly what you find in that device relative to any matter in this suit?

A. The two patents, the British patent and the United States patent, are substantially identical. The numbers of the figures are the same in the two patents. So, if I describe one it will answer for both. I think we need not consider any of the figures on the first sheet of the drawing; they show structures which I think are not material to this particular case. I wish to direct attention first to Fig. 5 at the top of the second sheet. It shows a pot magnet in a central core with the coil 6 wound around it. The top of the magnet forms the outer pole piece. It has a central aperture into which the upper end of the core projects, and from [113] which it is spaced to form a circular air gap. As shown in that particular figure, the outer pole piece is lined with a sort of a ring of, I believe, particularly soft iron, although I think Johnsen says that may be used, or not, in other words it is optional; in that Fig. 5 the upper end of the inner core is tapered, a straight side taper like a cone. The opening within the outer pole piece is of corresponding taper. So that the air gap is tapered. The vibrating coil which is shown centrally positioned in the air gap is also tapered at the same angle. That coil is connected through the members 14 to a sort of a stirrer, 15, of a microphone arrangement which dips into a chamber 22 containing granular carbon, or something

(Testimony of Samuel E. Fouts.)

of that kind, so as to serve the purpose of a microphone. That microphone is in a local circuit with a battery shown at the right. That local circuit steps up transformers which generate current out in the wires 20 and 21. So that Fig. 5 is specifically illustrated as operating a microphone.

In Fig. 6, we have a somewhat modified structure in details of the magnet pole pieces. We have the device operating a vibratory element which functions somewhat as a diaphragm of a telephone receiver. That is what it is supposed to be. In that case the end of the inner core only is shown. That part marked 31 is supposed to be the inner core corresponding to the part marked 1^c up in Fig. 5; but instead of tapering up pretty much to a point, or to a truncated cone, like in Fig. 5, Fig. 6 shows the end of the pole piece with a head on it, kind of enlarged and rounded; the part shown to the right with cross hatched lines is a part of the outer pole piece. It has a rounded cavity concentric with the rounded surface of the core head. The vibratory oil marked 3^d is within the air gap between the head 1^d and the outer pole piece 2^d. [114] That coil is, of course, made sort of hemispherical to fit in that curved air space. In this particular structure it is connected to the diaphragm 23 by rods 26 which pass through a sort of a guide plate or steadying plate 27. When pulsating currents are sent through the coil 3^d the coil will be vibrated and through those connections

(Testimony of Samuel E. Fouts.)

26 will cause the diaphragm to vibrate with it. That diaphragm seems to be mounted loosely within the sound box 25, which has a horn 24 extending outwardly from it. These shapes of pole pieces and the vibrating coil are matters of choice; they can be most any old shape. The patent says practically that in the very last paragraph of the specifications, on page 4: "The form of the field and of the coil can, of course, be modified in various ways as regards profile and cross section. They can be straight, broken, or curved in profile and cross section, and may be round, oval, polygonal," etc.

In Fig. 7, for example, there is shown a sort of conical cone similar to that shown in Fig. 5 which I have described, except that only one of these—well, I guess it is practically the same thing; I was going to say that only one of the microphones is shown. Only one is shown in both of those. So Fig. 7 is practically what is shown in Fig. 5.

Fig. 8 shows a cylindrical coil. That is also shown in Fig. 9 in the end view. It is just an open round device such as we have seen in the various patents before discussed. The Fig. 8 coil could not of course be operated in either of the air gaps of Figs. 5 and 6, it simply would not go in there; so it must have a correspondingly shaped air gap within which it can operate. That is described on page 4 of the specifications, beginning with line 28, in which it is said:

(Testimony of Samuel E. Fouts.)

"Figs. 8 and 9 illustrate a cylindrical coil which is employed [115] when the faces of the pole pieces which are directed toward the field and also toward each other are cylindrical, the coil 3^f being made cylindrical to correspond."

So when that shaped coil is employed the passing faces of the pole pieces will be cylindrical and spaced so as to receive this cylindrical coil. That coil is mounted upon a spider such as that shown in Fig. 11, which discloses a three-arm spider, or it may be a two-arm spider, as shown in Fig. 9. Figs. 12 and 13 show still other forms of spiders. In any of those forms the central part of the spider is attached to the end of the inner pole piece of the magnet by a screw which in Fig. 7 is indicated at 35. That screws into the end of the pole piece. Then to hold the coil to that screw a small screw 34 is inserted through the hub of the spider into the tapped-out end of the screw 35. Thus you get a structure which is almost the same as is shown in Plff's Ex. 4 so far as the mounting of that coil is concerned, and so far as the shape of the coil is concerned.

Q. Then if I understand the matter correctly, the Johnsen patent shows two forms of coil, one of which is bell-shaped or hemispherical, and the other of which is cylindrical?

A. It shows those two, and then it shows still another form here, Fig. 7, which is sort of conical. It shows the three and it shows several others. It says it may be round, oval, polygonal, etc.

(Testimony of Samuel E. Fouts.)

Q. Now, just look at the two colored pictures shown in this little blue book of mine on pages 14 and 15, the first one showing a bell-shaped coil and the other one showing a cylindrical coil, and state whether or not there is basis in the patent for those two representations, and in what respect do they represent the patent.

A. The first drawing to which you refer shows the structure shown in Fig. 6 of the patent mounted upon the pot magnet of Fig. 5. [116] Fig. 6 is on a larger scale than Fig. 5. I understand that photographs were taken of these two pictures of the drawings, and then one of them just superimposed on the other. That does build up the structure shown in this little blue book. The central part around about the coil is simply a photograph, somewhat reduced I think, of Fig. 6 of the patent. The rest of the magnetizing structure is, I understand, a photograph of the pot structure shown in Fig. 5, and the two put together. There certainly is warrant for doing that.

Q. Now, take up the other figure with the cylindrical coil and see if there is any basis in the patent for that.

A. That second drawing has the same pot structure of a magnet that is shown in Fig. 5 of the patent, except there was not shown that soft iron ring right around the opening. That is an optional thing, whether to use that or not. It was not shown in this drawing. It would not make any difference.

(Testimony of Samuel E. Fouts.)

It would simply show another insertion of a round piece in there. The magnetic structure is the same as shown in Fig. 5 with that exception, and with the further exception, too, that the opening for the coil is made cylindrical instead of tapered as it is in Fig. 5. The inner core or pole piece is tapered as it is in Fig. 5 until it approaches the air gap when it, too, is made cylindrical. So that the upper end of that inner core is cylindrical to fit within the cylindrical opening in the outer pole piece and leave a cylindrical air gap for the cylindrical vibratory coil of Fig. 8. I read what the specification said about Fig. 8. You have there the cylindrical coil which is used, it says, where the pole pieces are cylindrical and face each other. The way in which that coil is mounted to the inner pole piece is disclosed in Figs. 7 and 8 and in the specifications, the part which I read, and also in [117] the paragraph beginning at line 28 on page 4. Fig. 8 of the patent shows the spider arms 29—29 is the hub, the arms are 36; it shows the spider connected to a pair of microphones 15. The drawing which has been put in your little blue book, this second sheet, does not show the spider there operating microphones, but it operates a diaphragm like that of Fig. 6. That diaphragm is inside a sound box which is designated 25 as it is in Fig. 6. It has a horn 24 which is also as in Fig. 6. I consider that this structure shown in this second drawing of the little blue book is amply disclosed in the Johnson patent,

(Testimony of Samuel E. Fouts.)

and that the drawing is fully warranted by that disclosure. I may say that whereas Fig. 6 does not show just how the sound box is to be held in position on the outer pole piece, this drawing shows the sound box fastened to the pole piece in the conventional way as shown by numerous patents which already have been discussed; that is, it is screwed down, it is held in place by screws.

Q. I notice in the Pridham and Jensen patents the frequent use of the word "diaphragm." In what form is that diaphragm shown in those patents?

A. In the first patent in suit it is a disc which is clamped about its outer perimeter between the upper and lower parts of the sound box. Specifically, it is corrugated concentrically about the center there. So it is a sort of a corrugated disc. The next patent in suit shows in Fig. 2 a diaphragm not exactly like the one that is shown in the first patent. It is generally of that type. The one in the second patent seems to have two upwardly-directed corrugations and a sort of a depressed portion at the center; otherwise it is the same as in the first patent, as far as I see. In Fig. 4 of this second patent there is a perfectly plain diaphragm, just a flat plate without any corrugations on it, at all. [118]

Q. Is that diaphragm attached in any way at its periphery?

A. Yes. In all these cases it is clamped around

(Testimony of Samuel E. Fouts.)

its outer edge or periphery between the two parts of the sound box. It is a sort of a ring connection around the outside.

Q. What is the mode of operation of that diaphragm?

A. When force is applied to it it acts at the center—all these diaphragms, tending to push the diaphragm up at the center or pull it down at the center, vibrate it there, and as the diaphragm vibrates at the center it will vibrate out toward the edge but with gradual diminishing amplitude until it gets out to the place where it is clamped, where it cannot move. So you have the greatest amplitude at the center. That amplitude constantly diminishes as you go out toward the edge of the diaphragm, where it becomes nil. That is just what happens where you have the plain diaphragm of Fig. 4. Where you have the corrugated diaphragm the action would be somewhat modified because the corrugations, I think, would make the diaphragm a little more flexible; whereas you might get amplitude at the center, you might get greater amplitude at the center than you would in a plain one, you would get less, I think, as you get out toward the place where it is clamped. That is the general operation of them.

Q. What is the meaning of the word "diaphragm" in its broadest acceptation?

A. Well, in its broadest acceptation it seems to have been applied to most any sort of a vibratory

(Testimony of Samuel E. Fouts.)

member. In its more specific and, as I take it, its more accurate use it applies to some sort of a member which is attached around its outer edges and flexes in and out with its greatest amplitude in the center, like the so-called diaphragm within the human body, which is attached around the outer waist and separates the lung cavity from the abdominal cavity, it works up and down as one breathes. [119] That is true of a diaphragm.

Q. You are referring to what is known as the midrift in the human body?

A. Yes. The ear drum is another excellent illustration of what I conceive to be the true definition or true example of a diaphragm. It is fastened around its outer edges and vibrates with its greatest amplitude at the center. These devices shown here in these patents of Pridham and Jensen conform exactly to my idea of what a diaphragm is.

Q. You find in the latest patents also the word sound box; just state what that is.

A. Sound boxes did not originate, I think, themselves in the phonograph art, but I believe that term is applied to that structure. Structurally, it is about the same thing as shown, for example, in the Bell patent, which has been put in here as Defs' Ex. C. The term, as far as I know, was not applied at that time to the telephone receiver, although it is a sound box. It grew up in the phonograph art. I meant to say when you asked me what experience I had had that while I was in

(Testimony of Samuel E. Fouts.)

the Patent Office I had charge for two years of phonographs, or the art of acoustics, and became familiar with the terminology that was used at that time, and with the structures. A sound box is, as the name implies, a box. In its art it is a relatively thin box, one side of which is made up of a diaphragm. The diaphragm is clamped between the side walls of the box; the box cover projects over the outer face of the diaphragm and is separated a slight distance from it. That cover has an aperture opposite the center of the diaphragm. Usually, or, rather, often, I would say, the sound box is provided with a ferrule or something of the kind, to facilitate the attachment of ear pieces, or horns, or some amplifying device. That is my idea of a sound box, Mr. Miller. [120]

Q. Now, I have opened up the Magnavox machine which is in evidence here as Defs' Ex. A. I have taken off the top, as you will see. Now just show me the diaphragm.

A. This is the diaphragm, the part we have just removed, and which has the coil attached at its center. That has the corrugations of which I spoke a while ago.

Q. And when I put on the top piece like I do now, that little cavity between the under side of the top piece and the top of the diaphragm is the sound box, is it?

A. That is the sound box chamber.

The COURT: Q. Suppose that sound box

(Testimony of Samuel E. Fouts.)

chamber in the Pridham and Jensen patent was enlarged to correspond with what is now called the cone-shaped loudspeaker, would it produce sound without a horn?

A. I would not say it would not produce any sound at all; I think you would hear, probably, a little mouse-like squeak from it. That is about all you would hear. It would not be of any satisfaction as a reproducer of sound without the horn.

Q. No matter how large you made the so-called sound box?

A. To leave off the front part of the sound box, do you mean?

Q. Leave off the horn. Put every other element in it.

A. As I understand you, then, you want to know if you have the outer face of the sound box just like that exhibit enlarged?

Q. Enlarge every element in it, if you please; enlarge every element in it until it becomes a device as large as any one of the cone-shaped loudspeakers here in evidence, leaving off the horn, then would the device produce sound?

A. It would produce sound. I think it would produce sound, yes. It would be a distorted sound.

Q. Why distorted, any more than any other device?

A. For the reason that you are using the diaphragm within an enclosed chamber, and whenever the diaphragm is flexed it compresses the air within

(Testimony of Samuel E. Fouts.)

that chamber and the air to get out of that chamber must flow from [121] the outer parts toward the exit here at the middle; the mere fact that it is compressed in there gives rise to distortion of the sound waves.

Q. If it were not compressed in there there would not be any distortion. If you removed all compression and enlarged your box, what then?

A. Then you will have to remove the outer face of the sound box and take it away, and then you would have nothing but a couple of rings in there fastened on the diaphragm at the outer edge.

Q. I guess I don't make myself clear. I don't think I make myself clear to you, at all. The contention here seems to be that Pridham and Jensen have produced a device which requires a horn. Pridham and Jensen contend that everything that is necessary to produce sound is contained in this device which you have here before you. Now, then, I say, if we take this device and enlarge its dimensions will it not produce sound without a horn?

A. It will produce sound, yes.

Mr. MILLER: Q. What kind of sounds will it produce?

A. They will not be as sounds produced in free air, they will be distorted sounds.

The COURT: Q. Supposing you put in that aperture in that enlarged sound box a cone-shaped instrument, which of course would have some effect upon those sounds, would it not produce the same

(Testimony of Samuel E. Fouts.)

sounds which are produced by these other devices which are introduced here in evidence?

A. If you had a cone within a sound box, do you mean?

Q. Yes.

A. Yes; I think it would produce distortion. You would get a sound, but it would be a distorted sound; it would not be the pure tone sound.

Q. What gives the pure tone sound to these other instruments? [122]

A. You mean the cone instruments?

Q. Yes.

A. The force which causes the cone to vibrate is the force of the air waves. That is the originating of the current. That is what originated the current. I will put that this way. To originate those forces which cause the cone to vibrate there is some sound made which sets up pulsating currents in the coil of the cone. If those currents which are in that cone are in exact synchronism with the sound waves which produce them and there has been no distortion up to that point, they will act upon this diaphragm and will cause it to move back and forth in substantially a unitary movement; that is, it will move just as far at one point as it will at another, like a piston. That will set up in the air sound waves which exactly correspond, or substantially correspond, with the sound waves which set up the forces in the first place. That is, if somebody talked over through there and we were repro-

(Testimony of Samuel E. Fouts.)

ducing it here, it would be a faithful undistorted reproduction, because these waves have been pushed out and have not been compressed in any restricted space, and they would go just right out in the free air.

Q. The elements contained in these devices are simple and well known to the art, are they not? You will find the same elements in the conical loudspeakers that you find in the Pridham and Jensen loudspeaker. Is that not so?

A. You will not find in the conical loudspeaker any soundbox or diaphragm.

Q. Sound box or diaphragm! Can you produce sound without a diaphragm? Can you produce sound in any of these devices without a diaphragm?

A. You have to have a vibrating member and I suppose you can call it a diaphragm. A diaphragm generally is a circular disc.

Q. I don't care what you call it; you have to have something sim- [123] ilar to a diaphragm to produce sound, don't you?

A. Yes.

Q. In the telephone, or in any of these loudspeakers?

A. I think so.

Q. Now we say that the voice is amplified in the Pridham and Jensen devices by the use of a horn; in the conical loudspeakers it is amplified by the use of a cone. Is that not so?

A. In a sense, yes, that is true. It is amplified

(Testimony of Samuel E. Fouts.)

in the Pridham and Jensen structure by the use of the horn. In these others we get even greater amplification without a horn, and we get it because we have a cone, if that answers your question.

Q. If you take the elements that are contained in Pridham and Jensen and enlarge them, or if not enlarging them making such an arrangement of them as will permit the use of a cone, will you not get the same effect and produce the same sounds that the so-called conical loudspeakers produce?

A. I think so, if you arrange the parts there so that you can use a cone and do use a cone in there and not cause the movement of the cone to compress the air within some restricted space and then give it out again so as to distort the sound waves. If you can enlarge this structure through here so as to adapt it to one of those big cones and mount the cone in a frame open-like structure such as you have here, you practically have a cone instrument then, and it would play like it.

Q. Is not that what the defendants here have done?

A. The defendants have used a cone, yes.

Q. I say, isn't that what they have done?

A. I think that would be a fair thing to say, yes.

Q. As applied to this case there is not any magic to the words "free air," is there, because we have free air in a horn and we have free air in a cone.

A. You don't have a free air in the sound box.

(Testimony of Samuel E. Fouts.)

That is where the trouble comes in. After the air gets out [124] of the sound box and gets into the horn you don't have very much trouble with distortion. The distortion is in the sound box before it gets to the horn.

Mr. MILLER: Q. Diverging for a moment to another point, does this diaphragm which I have removed from the structure of Defs' Ex. A show the narow metallic strips referred to in the patent?

A. Yes, thin metallic strips.

Q. Now, will you show me or tell me the difference in mode of operation of the diaphragm and the sound box of the plaintiff's patent and the cone of the defendants' machine?

A. In the sound box of plaintiff's patent the vibration of the diaphragm causes air to be compressed in that very shallow chamber of the sound box. These vibrations set up in that sound box waves of compressed air which travel toward the center and then emerge out through that ferrule at the center into the horn. That compression of the air within the sound box is what results in a distortion of the waves of the air. They do not issue directly from the diaphragm into the open free air, but are sent forward against the forward wall of the sound box, reflected back, etc., and by the time they have got out they have been distorted.

The COURT: Q. At the time they get out they are distorted; what happens after they get out?

A. They get out in the horn. The horn has

(Testimony of Samuel E. Fouts.)

a relatively large body of air that is within it. It is a good deal like the pipe of an organ, where a very little energy at the end of the pipe will set all the air within that organ pipe in motion so that it produces quite a considerable noise. That is what happens when these sound waves from the sound box finally get into the horn. Coming into its throat, it sets all this mass of air within the horn into vibration, whereas there was a very small amount of air in vibration in the horn; [125] it is sufficient to set all this big column of air in the horn into vibration, and that gives you considerable sound.

Q. The sound is not then distorted, is it, after it gets into the free air in the horn?

A. It is not further distorted, but the horn does not correct any distortions which have previously occurred; that is, if it is distorted when it gets to the throat of the horn it will emerge from the horn probably without any further distortion, but it certainly will not correct any distortion which had previously occurred before it got to the horn. That is the difference between the sound box operation and the operation of the conical structure.

Q. The difference would then be, would it—— I will put it this way, in a measure the difference would be, in the Pridham and Jensen devices, as shown by these patents here in evidence, the compressed air which is distorted and travels toward the horn gets its free air in the horn, and in these

(Testimony of Samuel E. Fouts.)

devices of the defendants here the free air is in the cone?

A. Yes, I think that is pretty well put; I believe that is right, it is in the cone, and as the cone moves forward it just shoves the air right forward with it and it will go freely from it without any interference from any sound box structure, or any other structure.

Q. There is no interference, is there, in the Pridham and Jensen device——interference with that air you have mentioned?

A. Why, yes.

Q. Where is the interference?

(Witness refers to an enlargement of the patent drawing).

A. Now here is what I have been trying to explain. When this coil vibrates up and down this way, and Mr. Pridham said yesterday it sometimes goes half an inch, it goes one-quarter of an inch up and one-quarter down, and when it does that it makes a full half inch in amplitude. When that diaphragm, we will say, moves up there is a space in through here; [126] this diaphragm, of course, forms the lower wall of that chamber in there; as that flexes up it closes up this space; the air that is in there is squeezed, it is compressed; the only way it can get out at all is to flow laterally from this position over to here, or from this position over to here. That is what I have said resulted in the distortion of the waves, because instead of the air

(Testimony of Samuel E. Fouts.)

going right straight out it has been dashed against this inner wall through here, and then probably reflected back to the diaphragm, I don't know how many different reflections it would have in being battered back and forth until finally it is squeezed laterally and gets in the column of air. This air at the center will not have that distortion, or at least not so much of it. The wave of air that will be pushed forward from the center part will go direct down and into the horn. This part back here underneath the overhanging portion of the sound box will be compressed and the air will be squirted in from the side and it will not exactly be in phase with the waves shot out directly from the center; that is, you will have a portion come out here, and a portion out here, and finally join there. It will throw it out of phase. That is another thing that results in distortion.

Q. What effect does it have on the sound, if any?

A. That is hard to explain. Instead of there being a sound wave which would have a sharp turn it would be smeared, so to speak, it would be kind of spread out and be dulled. It is a hard thing to explain.

Q. You were speaking of this distortion of air. I would like to know what that means. It certainly does not destroy any sound waves that are in there, does it?

A. It does not destroy them, it just simply puts them out of their true form.

(Testimony of Samuel E. Fouts.)

Q. How do you know that?

A. All the literature teaches it.

Q. What does that mean, anyhow? That is just somebody's idea [127] about it, or guess about it, really, is it not, because they don't know?

A. Oh, I think they do know, your Honor.

Q. That distorted air comes out of there, and when a horn is applied it makes sweet music, we will say, or it gives the sound of a voice clearly. So the so-called distortion has in no wise affected the sound that is produced, has it, so far as anybody knows?

A. Oh, I think so.

Q. What makes you say that, Judge Fouts? Is it because you don't like a horn on a radio?

A. No; well, as a matter of fact, I don't like a horn on a radio.

Q. I don't think, either, it is convenient, but there are many people who think that a horn produces the better and the clearer sound. So then your so-called distortion of air does not mean anything, I don't think.

A. The horn does not operate very satisfactorily, on the tones of low frequency; on tones of high frequency it is more satisfactory.

Q. Of course, the conical-shaped loudspeaker is the one that is preferred now. There is not any doubt about that. You will find them, I presume, in all of the radios that are sold today.

(Testimony of Samuel E. Fouts.)

A. Practically so, I think.

Q. But there are many people who will tell you that the sounds produced by a horn are more pleasing to them than the sounds produced by a conical loudspeaker. So I cannot see what this argument of yours about distorted air means. I take it it does not affect the sound in any way.

A. I think that is where we have failed to make this plain to you. I don't know whether I can do it, or not.

Q. Judge Fouts, I can not see these things as plainly as you do. I don't think I can, because I have not had the experience in patent work that you have had. I doubt not but what I am [128] expressing myself very awkwardly to you.

A. There is not in evidence this Rice and Kellogg article, is there, Mr. Miller?

Mr. MILLER: I am going to put it in.

The WITNESS: Yes, you are going to put it in. That is a very instructive thing. They tell why this distortion occurs, what it is due to, and what they have done there, as they think, to remedy it. That might throw more light on it than I am capable of throwing on it. As to whether two different persons would prefer to hear one of these conical instruments or a horn instrument, or whether one would prefer one or the other depends, I think, largely on the training of the ear and on whether or not one would be able to detect a distortion of sound will depend upon the training of his ear.

(Testimony of Samuel E. Fouts.)

There are some people that I have known that I am sure could not tell one from the other. There are others who think they detect a great deal of difference between the two.

Mr. MILLER: Q. What is the mechanical movement or operation of the cone?

A. On vibrations of low frequency it is a bodily movement, that is, like a piston or a plunger, will produce a moving together with the same amplitude throughout. As the vibrations increase the outer portions of the horn seem to flex somewhat so that it does not move quite as far as the inner part. I think in this Rice and Kellogg article that you are going to speak of and also in Kellogg's patent, they say that when you get up to frequencies of between 3000 and 4000 then it ceases to move absolutely as a unit, but the outer parts, due to their own inertia, do not move quite so far as the inner part. If the cone moves forward it shifts the air in front of it, and it must do work in doing that, in displacing the air, and when you get up to a frequency of 3000 or 4000 that will result in the amplitude of [129] the outer part of the cone falling off a little bit. As a general proposition, you can see that it moves as a piston or as a plunger. That is true if the cone is made small, or even in a large cone if it is moved with slow frequency.

Q. You say the cone moves bodily up and down like a piston?

A. Yes.

(Testimony of Samuel E. Fouts.)

Q. And the diaphragm vibrates from the center to the circumference?

A. Yes; that is, the diaphragm that is clamped around its edges can not move where it is clamped and the central part will have the greatest amplitude, and it will just fall off gradually from the center out to the edge. It varies in amplitude from the center out, whereas in the cone type the amplitude is the same throughout the entire extent of the cone.

The COURT: Q. In a cone type, is it not merely an enlarging of the diaphragm?

A. I could not see it that way, your Honor, no.

Q. It has been enlarged, has it not?

A. It may be and generally it is. These are. Sometimes they make them smaller than that. I have two in my own home that are smaller than that—I think they are.

Q. Smaller cones, you mean?

A. Yes.

Q. How much smaller would you say?

A. I think mine is six inches across; this is about eight and a half.

Q. In the center of that cone which you have just measured is the diaphragm. Isn't that so?

A. Here is the cone, from here to around here.

Q. Where is the diaphragm?

A. Well, if you call it a diaphragm at all, and assuming it as the proper term, it would be the part that would be moving up here. It is the cone part.

Q. Then I say the diaphragm part has been enlarged to that extent, has it not?

(Testimony of Samuel E. Fouts.)

A. Yes. As this moves up and down you can see it [130] goes as a body, as a unit; it is not held out here and pushed up from below so that you get all your flexing at the center practically.

Q. What difference does that make?

A. In a structure of this kind, whether it is all open out through here, I don't think it would result in distortion, but it would diminish the amount of air that would be displaced, and would go down in the form of sound. Of course, the matter of a horn or no horn would come in there.

Q. I have heard something about self-sustaining sound waves in this art that is produced by these cones; just what is meant by that term?

A. That means that these cones, as they vibrate forwardly, will push the air and start up a sound wave. As they come back——

The COURT: Q. Where do you get your authority for that? Does anybody know that?

A. I thought that was primary in the art.

Q. There are a lot of things they talk about that they say are primary in the art and I wonder if they know what they are talking about.

A. If you take a bell and strike it with a tuning fork it vibrates back and forth. That always happens. Every time it comes forward and every time it comes back it will send out pulsating waves on the air. That is what happens with one of these cone devices. I have not a tuning fork or a bell. The whole thing goes forward like a piston and it

(Testimony of Samuel E. Fouts.)

gives a hunch to the air and almost immediately after that it gives another hunch to the air, and sends the air out in these waves of air, the self-sustaining waves of air, into the free atmosphere.

Q. I suppose the waves from a horn would do the same thing?

A. After it gets out, yes. The trouble with the waves is before they get into the horn. That is where the distortion comes. If [131] they could straighten out the distortion after getting into the horn it might come out one way or the other all right, one end or the other. That is the trouble.

Q. You think it comes out one end sour, do you?

A. Yes, because it goes in sour. I don't know whether I make myself plain on that, or not. If the waves that go into the horn are in any way distorted the horn will not remedy the matter, it will make it louder but it will not straighten out the trouble, it will come out the big end of the horn just as bad as it went in, and in a magnified way.

Q. Of course, we have all had radios. On our first radios we had horns. I think they are very good.

A. We thought they were good in those days, your Honor. You don't use one now, do you?

Q. Oh, no. I have a radio, of course, the same as everybody else has. I presume it has a cone in it of some kind.

A. I used to think my old horn type was good, too, but I don't think I would like it now.

Q. Have you looked at the file wrapper con-

(Testimony of Samuel E. Fouts.)

tents of the Pridham and Jensen patent No. 1,448,279?

A. Yes, I have.

Mr. MILLER: I offer it in evidence and ask that it be marked appropriately.

(The document was marked "Defs' Ex. AA")

Q. Now, I don't want you to plow through the interminable rejections of the Patent Office and the subsequent amendments, and the lengthy arguments of Pridham and Jensen in regard to this patent, I just want you to refer to one particular thing in this file wrapper which has a bearing upon the case here, and particularly upon claim 8 of the patent.

A. I notice in paper No. 5, amendment B, filed April 19, 1922—that is the office stamp of the date, the date given on the paper, itself, is April 4, 1922, [132] in that amendment I notice a claim which was then numbered 7. It stood in the case at the time that the Johnsen patent was discovered by the examiner for the first time. It was rejected on Johnsen.

Q. What was the claim and how was it worded before the rejection?

(Witness reads canceled claim 7)

The COURT: Q. What is the difference in the wording of claim 7 which you have just described and claim 8?

A. "Means within the casing for retaining said pole pieces in spaced relation." That is all. What

(Testimony of Samuel E. Fouts.)

this means to me is that Pridham and Jensen admitted that claim 7 is clearly anticipated by Johnsen. They asked for allowance of that claim on the ground it added to the subject-matter of claim 7, "Means within the casing for retaining said pole pieces in spaced relation." The claim was allowed. So that is the novel feature of the claim. Any means—the claim does not define any means for doing it. It is simply "any means."

Mr. MILLER: Q. So the only novelty in that claim, then, is means for spacing the pole pieces?

A. Yes.

Mr. MILLER: I offer in evidence the file wrapper and contents of the Pridham and Jensen patent 1,266,988.

(The document was marked "Defs' Ex. BB")

Q. Have you examined the patent issued to Kellogg, No. 1,707,617, of April 2, 1929, applied for on January 9, 1925?

A. I did, yes.

Mr. MILLER: I offer in evidence this Kellogg patent together with a publication printed by the patentee in September, 1925, explaining the invention and the operation thereof.

The offer was objected to on the ground that the patent was later than either of the two patents in suit and was immaterial so far as concerned any issues in this case. The objection was sustained; whereupon Mr. Miller stated, "I don't want to submit it as a proof of anything; I want it as part of my argument." [133]

(Testimony of Samuel E. Fouts.)

The COURT: I will admit it in evidence for that purpose.

Thereupon the patent and the publication were marked "Defs' Ex. CC to be used as a part of Mr. Miller's argument."

Mr. MILLER: Q. Yesterday, at the time of the interruption when you were asked a number of questions by the Court, had you quite finished the matter that you had under discussion before those questions began?

A. No, sir, I had not.

Q. Will you now please finish it?

A. I had only spoken of the distortion of the sound waves within the sound box as being one of the reasons why the sound box diaphragm and horn combination would not give as good a reproduction as the freely-floating cone——

The COURT: I think that is a matter of argument, and a matter of sales talk, probably. I don't care to hear anything more about that.

A. (continuing) I was not going to say anything more about it; I said that that was as far as I had got. There are a couple of other features that I did mean to speak about. Every vibrating member has a natural frequency or periodicity, that is, whenever impulses are set up about it, when they reach a certain frequency they will set this body into vibration. That occurs in the diaphragm of the sound box, and gives rise to what has been termed a blasting effect; that is, a phonograph may

(Testimony of Samuel E. Fouts.)

be playing along smoothly and satisfactorily until there is this particular frequency of vibration imposed upon it, when it will give out a roar or a blasting sound which is very unpleasant and disagreeable——

The COURT: Q. It is directed toward what issue?

A. On the question of the equivalency of the sound box diaphragm and horn combination and the freely-floating cone. Of course, structurally they are quite different. I was trying to show that they function in a different way and give different results. [134] This is one thing which is characteristic of the sound box, diaphragm and horn structure which does not apply to the freely-floating cone structure. I know that I have, and I daresay most of us have who have listened to the sound-box-diaphragm horn, observed this blasting effect. It is not speculative on my part. I have heard it, myself, many times. That is something that does not occur in the freely-floating cone type of instrument. Then the other thing that I meant to talk about is that the sound-box-diaphragm-horn combination does not satisfactorily reproduce the low tones. They may be satisfactory for the higher notes, but it does not reproduce the low thunderous tones such as one gets from pipe organs, or cellos, or bass viols, or bass horns. These tones are satisfactorily reproduced by the freely-floating cone type. The article which has been introduced here for the

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purpose of argument, that is, the Rice-Kellogg article, brings that out very clearly and—I would like to call the Court's attention to a picture that is in there that is just simply illustrative of the point I am trying to make. May I do that, your Honor?

The COURT: Yes, certainly.

A. (continuing) This is my copy of it. We have here, on page 983, and this is entered as Defs' Ex. CC, in the Fig. 2, a set-up which was made by these research men of the General Electric Company; they were trying to develop a loudspeaker; they finally did develop a loudspeaker known as the R.C.A. 104—— They were trying to bring out all of the tones, high, intermediate, and low. So they set up this arrangement here, where they had three different horns, different sizes——

The COURT: If it is all described in there, do not repeat it to me.

A. (continuing) Yes, it is, and I can tell you what they found [135] out.

Q. That is all stated in there, too, isn't it?

A. It is. They found that even with that arrangement there——

Q. That the horns were not satisfactory?

A. That the big horn would not give the low tones. So they went to this floating diaphragm cone to give all tones.

Mr. LOFTUS: It all goes back to the quarrel between the Western Electric and the General Elec-

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tric, as to whether the cone was better than the horn. That battle has been going on for yars. The article the witness refers to is mere propaganda.

A. (continuing) They found out this gave a better reproduction of low tones than even the exponential horn that they had, and also that it gave the higher tones. So they did not give this entire combination anything, and they threw the whole thing away, and relied on one floating cone, which gave better results than the three of them together. That is the substance of it.

Q. You were about to refer to some patents obtained by Edison. That was the matter before us last evening when we adjourned. You may tell the Court something about those.

A. Yes, your Honor.

Mr. MILLER: Q. Considering for a moment the diaphragm shown in the Pridham and Jensen patent, consisting of a circular metal plate attached permanently at its periphery, is there any peculiar thing or characteristic about diaphragms of that kind that is known to the art, and which would militate against their perfection or efficiency in reproduction?

A. It has this natural period of vibration, of resonance in itself, and no matter how big the diaphragm would be, if it is clamped about its outer edges this natural periodicity will develop in the use of the instrument, it will give out the blasting sounds to which I referred a while ago. It can not

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be avoided, no matter how big they make the diaphragm. [136] You may get increased tones, but it will always be subject to this blasting effect when the frequency imposed on the diaphragm corresponds to the natural frequencies of the diaphragm as a member.

Q. Would that result in imperfect operation in reproducing sounds faithfully?

A. Yes, it would. I may also say that the horn, when it is applied to the sound box, also has its natural periods of vibration, its own resonance, and whenever the vibrations that are imposed upon it correspond to its periods of vibration the two will go into action and give out this blasting effect.

Q. What article are you referring to in this last answer?

A. I am talking about the sound box, diaphragm, horn combination. Whether it is made exactly according to the patent, or made any other way, it is inherent in that combination to have these two elements do this blasting that I speak of.

Q. Does that defect or default inhere in the paper truncated cone, at all?

A. No, not to any such extent as in the combination of which I spoke. The paper cone is made of such very light material, and it is so flexibly mounted, that the natural periodicity of the cone is so low that it is without the range, that is, substantially without the range of frequency of reproduction, that is, outside the range of the lowest

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tones which are reproduced and the highest notes. They try to get it that way, and it is substantially so. It is made so very light and so flexibly mounted that it was not objectionable, anyway. I have had two of those in my own home for three years, and I have never heard a blasting sound out of either of them so far.

I will now take up the five prior patents showing the thin metal strips. The first one is the British patent to Edison, No. 2909, of 1877, marked "Defs' Ex. V". The part that I wish to direct attention to is shown perhaps best in Fig. 1, although it [137] appears in some of the other figures. You see the diaphragm *w* and just below that extending in from the edge of the diaphragm to the center is this little member *x*, and that is the conductor for the current which leads to the center of the diaphragm. Mr. Edison says, on page 5, line 33:

"In all instances the telegraphic circuit at the diaphragm is made by a thin strip of platina or similar material extending to the center from the line or battery connection."

That is a thin metallic strip which leads the current to the center of the diaphragm.

The next patent is U. S. Patent to Edison, which has been marked here "Defs' Ex. W". This shows a structure very similar to the British patent I referred to. The diaphragm is shown at *b;* this thin metallic strip is shown at *e*. The reference in the

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didn't get the question right. Just what was that question?

(Question read by the reporter.)

The WITNESS: I wanted to get it straight before I started out. Now, taking that British patent and reading claim 8——

The COURT: Well, does that stand as your answer to the question, the Siemens British patent, Ex. E, No. 4685, of 1877?

A. I say that is my best view of that matter. I say I realize that the metal strips are not disclosed there. Counsel asked for one single patent. I want to read the claim on Fig. 5 of that patent: "In a receiver for telephony—and that is what this is, it is a receiver for telephony—"the combination of a sound-box and its diaphragm"—and you have there the sound-box—You have the sound-box and the diaphragm in Fig. 5. "of a magnet field"—that certainly is present; "a vibrating conducting coil for the telephonic currents disposed in said field"; that is present there; it is an annular coil that moves up and down in the circular air gap of that magnet field. "and rigidly secured to the diaphragm"—that is also present. "and connections between said coil and the operating circuit." Now, obviously, Siemens had to have an operating circuit, and he had to have connections between the operating circuit and that coil. He does not show what kind of conductors he chooses to use for carrying the current in and out from that coil;

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consequently, he does not show the thin metallic strips secured to the diaphragm. That is all that Siemens lacks.

Q. In other words, he does not show the combination?

A. He does not show that specific kind of a conductor. In fact, he [140] does not show any conductor at all, but that must be read into the disclosure there, because it necessarily must be present.

Q. Turning to Fig. 6 of the Siemens patent, there is a sound-box and diaphragm shown there, too, is there not?

A. No, I don't think there is.

Q. Why not?

A. You have that trumpet-shaped cone, which is open at its upper face to the free air. There is no box structure there, that is, there is no sound-box chamber in front of that cone. That, in my view, is necessary to make a sound-box.

Q. Don't you consider that the type of diaphragm and mounting in Fig. 6 is the equivalent of the type of diaphragm and mounting in Fig. 5 of that patent?

A. No.

Q. And yet they are shown side by side in one and the same patent?

A. They are shown side by side.

Q. Going back to your own Patent Office rules, wouldn't that be considered an equivalent?

A. No, not necessarily.

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Q. You would not allow them in one and the same patent, then?

A. I would not probably allow claims to the specific structure in Fig. 5 and then in the same patent allow other claims for the specific structure in Fig. 6. They might take out two patents on the two things.

Q. Don't you think this patent taught the art that the open type of sound-box with a conical diaphragm was the equivalent of the closed type of sound box with the flat diaphragm?

A. No. It may have taught the art that the two structures there could be used to give off sound waves, but it did not teach that they could do it in the same way. That is necessary to make the two things equivalent.

Q. You do not find all the elements of claim 8 of patent 1,266,988 in your one best reference. Is that correct?

A. I don't find [141] those metallic strips in that patent. You have to use another structure with it.

Q. You have to build up a Mosaic?

A. You have to substitute thin metal strip conductors for whatever conductors Siemens did use. He had his choice, of course, as to whether he would use one or another to carry the current in. He had to use something. Now, then, the question is as to invention in selecting the thin metallic strips from the prior art to put on the Siemens diaphragm.

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Q. All these other patents that you have discussed in connection with claim 8 of patent 1,266,988 are transmitter patents, are they not? I refer now to Edison, Rogers, Richards, and Shreeve?

A. Fig. 1 of the Edison British patent is a transmitter, but he shows perhaps a dozen different set-ups here, and I can not tell without studying the specification whether they are all transmitters or whether there are some receivers. I would have to spend some time before I could give you a specific answer to that.

Q. Now, with respect to the second patent in suit, 1,448,279, pick out your one best and closest reference to claim 8.

A. There is little to choose as between the Sir Oliver Lodge structure shown in Fig. 5 in "The Electrician" of January 6, 1899, Ex. K, and the United States patent to Pollak, No. 939,625. Both of those patents disclose every element of the combination of the claim except the sound-box with its diaphragm. Both of them have a vibrating member which is connected to the vibrating coil. The vibrating member is not within a sound-box. I should like to apply that claim to these structures.

Q. You may do so.

A. Take the Sir Oliver Lodge magnet, Fig. 5 in "The Electrician," it is an electrodynamic receiver—

Q. Right there, let me ask you this question: Is that a loudspeaker in any sense?

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A. Yes. Your patent does not say anything about a loudspeaker. [142]

Q. Is this Sir Oliver Lodge instrument even a telephonic receiver? He designates it as a syntonic receiver. What do you understand by that?

A. A pure syntonic receiver is one that gives out or receives a single tone.

Q. Which would not be a telephone, or a loudspeaker, would it?

A. If that is what it actually does, it would not be adaptable for giving out broadcasting, various kinds of tones, no. But that is not what this is; he uses it for that, yes. I think probably he tried to adapt it to that particular purpose, because he says that while it worked fairly well, or something to that effect, until he loaded it with the heavy copper wire, that that dampened it so that it was not so much good as a syntonic receiver. This structure was used as a receiver for the voice. I think this article makes that very plain.

The COURT: Q. You don't mean to say that Sir Oliver Lodge didn't know what he was doing, do you?

A. No.

Q. He said it was a syntonic receiver.

A. It was adaptable for use as a syntonic receiver, but when he put that other coil on it upset the syntony, and he must have made it adaptable then, for receiving all sorts of tones. That is what I think it was intended for.

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Q. To receive all sorts of tones?

A. Yes.

Q. He said a single tone. I don't think there is much room for argument as to what Lodge intended since his deposition was taken.

A. I find on pages 4 and 5 of the Lodge British patent 9712, of 1898, which is Defs' Ex. J, a statement with reference to that structure shown as III in Fig. 6 of the drawing; that is an instrument very similar to this instrument that is shown in Fig. 5 of the publication "The Electrician" upon which I was relying. In that part of the specification Lodge says: [143] "The final instrument of the series is usually a loudspeaking iron disc or diaphragm telephone of some ordinary pattern suitable for importing vibrations to the air and so on to the ear, or it may be an electrodynamic or a Langdon-Davies phonophoric receiver or other instrument, for example, that shown in Fig. 8 whereby the vibrations are enabled through a relay to work a Morse or other telegraph instrument. I may use this plan of magnification as a call, or as a receiver in magnetic telegraph, but it is obviously applicable to other useful purposes, such as magnifying a speaker's voice by distributing it to various parts of a large hall." It seems to me that he means that that instrument III of Fig. 6 was intended to receive and send out speech. As I say, it is very similar to that shown in Fig. 5. I have not the slightest doubt that that would receive and give out articulate speech. As I said in

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the very beginning of this answer, there is probably no choice as between Fig. 5 of the Lodge structure and the United States patent to Pollak.

Q. Pollak has not anything to do with telephony, either as a telephone receiver or a loudspeaker, has it?

A. It does not have, as I said in the beginning, a sound-box structure; it is a device there, or a sort of a microphone arrangement, that is used in the reproduction of speech. It has the entire magnetic structure, a center core, the pot, and the means for spacing the poles, and the vibratory coil within the annular air gap, the vibrating coil connected to a diaphragm. That diaphragm does not, as I said, send out speech directly, but it serves as one of the elements of a microphone, and eventually the amplified sound is received down at the instrument shown in the lower part of Fig. 1.

Q. What has been your practical experience in subjects of this sort, that is, telephone receivers and loudspeakers? Have you [144] ever built any or made any tests of a practical nature?

A. No.

Q. All that you know about the subject is what you read in the Patent Office literature: Is that correct?

A. No, that is not correct.

Q. Then amplify your answer and explain it.

A. Going away back into the nineties, I have had phonographs and sound-boxes and horns.

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Q. Yes, in your home, like all the rest of us.

A. (continuing) And down at the Patent Office we had them there, too, and very frequently people would come in to make demonstrations on other instruments, so that I became fairly familiar with them. In my home I have at the present time a radio.

Q. We all have them. The Court has them, the reporter, and all the rest of us.

A. Yes, I suppose so.

Q. I am asking for practical experience as to constructing, and experimenting, and testing.

A. I answered that I had not done that, anymore, perhaps, than you, yourself. I am monkeying with my radio quite a good deal, trying to see how it is put together, and all that, but I never built one, no.

Q. Where did you get this theory of distortion that you were trying to explain to the Court yesterday?

A. I don't believe I can tell you just where I got it initially. I told you yesterday that I was for two years the examiner of the art of acoustics while I was in the Patent Office. During those two years I made it my business to learn what I could about the subject. I was handling particularly graphophones—phonographs, which was quite an active art back in those years. In connection with the Patent Office we had a large scientific library and a great deal of literature on the subject, and I made

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it my business to try and get myself informed on it. I think it was back in there [145] that those things kind of soaked into my consciousness. How I came to distinguish between the printed words "cat" and "dog", I could not tell you, but it was away back yonder somewhere.

Q. You don't mean to assert now that the sounds emitted by a horn are any more distorted than those emitted by a cone without a horn, do you?

A. Yes.

Q. That is simply your own observation from listening to one or two comparative devices?

A. It is my observation, and it is conformable to theory, too, scientific principles, as I have endeavored to explain.

Q. Would you agree with this statement, Mr. Fouts: "By flaring out to a large diameter at the open end"—speaking of a horn, "the effect is to replace the source which of itself has a very small area by a large nearly-flat source of equal rate of working, which is better adapted to radiate into infinite medium"—speaking of sound waves.

A. I don't understand what that means. I don't know whether I agree with it, or not.

Q. Where did you obtain your ideas of what a sound-box consisted of?

A. That was a term that was applied to the sound-box structure in the phonographic art; that is what a sound-box is, in my opinion.

Q. You got it out of the Patent Office literature?

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A. What do you mean by Patent Office literature?

Q. United States patents or other patents.

A. Yes, I don't doubt you will find that in a very great many patents, that term.

Q. Will you look at the Lumiere patent 1,036,529 and state whether or not you find a sound-box therein?

A. In the drawings of the patent I do not find anything that I should call a sound-box, no.

Q. Yet it is so described, is it not, and so claimed?

A. Yes. [146] This is a Frenchman, and I imagine he knows as much about the English language as some of us know about French. We probably would make the same mistakes.

Q. And yet that was passed and approved by the United States Patent Examiner, such as you were, was it not?

A. Apparently so.

Q. Did you happen to be in that division at that time?

A. No. This was filed in 1910; I was gone from there a long time before that.

Q. So that whether or not Lumiere was a Frenchman, it was up to the patent examiner to approve that expression as being substantially correct?

A. It was up to him either to pass it or to object to it. I don't know whether he objected to it, or not. Anyway, he ultimately did pass it, yes.

Q. So that what he shows there is known in the patent office as a sound-box?

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A. I don't think that is a fair way to put it, no. This single instance might have got by. I don't think that is any precedent to be relied on.

Q. Have you ever heard of Dayton C. Miller, of the Case School, at Cleveland?

A. Yes.

Q. He is an authority on the subject of acoustics, is he not?

A. I understand that he is.

Q. Have you ever read his book?

A. No. How recent is his book? I don't think that I did.

Q. This one was published in 1916.

A. No. I thought if it was in the scientific library of the Patent Office while I had charge of the art I might have read it.

Q. You would be inclined to accept his definition of a sound-box, would you not?

A. Well, he ought to be pretty good authority on the subject.

Q. I hand you a photostat and call your attention to the struc- [147] ture shown at the extreme left between the two rows of figures, and ask you if that is a sound-box and diaphragm.

A. You are asking me about this, are you?

Q. The structure at the extreme left between the two rows of figures, in Fig. 121.

A. And your question is whether that is a sound-box?

Q. And diaphragm.

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A. I certainly do not think so. In glancing over this hurriedly, I do not see where he says it is.

Q. I have not shown you all the book. So you are prepared now to disagree with Dayton C. Miller, are you?

A. If he says that is a sound box down there I should disagree with him.

Q. What about the structure at the extreme right of the top row of figures, is that a sound-box and diaphragm?

A. I assume that those elements which extend to the left there are the outside or front side of the diaphragm, so that the waves which are sent out of the diaphragm would travel to the left in that picture. I am assuming that.

Q. That is my understanding of it, yes.

A. Like it is in those other figures, in the same row, there?

Q. Yes.

A. I should not have called that a sound-box, no. I don't believe that term can properly be applied to that structure. Those others in that row I think are sound-boxes.

The photostat of Page 155, Dayton C. Miller's Book, referred to above, was marked "Plff's Ex. 7 for identification."

Q. Are you prepared to say that if the diaphragm and sound-box as illustrated in the Pridham and Jensen patents in suit were enlarged to correspond with the size of the cone diaphragm

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in either of the defendants' devices, and keeping in mind at the same time the opening shown at the top of the sound box would be correspondingly enlarged, that audible speech or music of sufficient volume that could be heard throughout a large room or auditorium [148] could not be reproduced? That question might be rather lengthy, but I want to get the witness pinned down to his reasons for that, because we can readily demonstrate the effect of it.

A. No, I would not want to say that it could not be heard. Those close to it could hear it. Whether those farther back in the auditorium could hear it, I don't know, but I would not want to say they could not.

Mr. LOFTUS: Q. In other words, you don't know; you have never tried it?

A. No, I have never tried it.

Q. And it is mere speculation, so far as you are concerned?

A. Yes.

Q. Why do you say that a cone diaphragm moves as a piston? Where did you get that theory?

A. From various sources. I have observed the operation of cones pretty carefully, and it seems to me they were so moving as a piston. Then the literature on the subject, and particularly this article of Rice and Kellogg, so states, that is, they move as a piston if the diameter of the cone is not too great, or if the frequency of vibration is not

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too great. If you increase the diameter and increase the frequency, then you depart somewhat from the pure piston action.

Q. Would you, if requested, know how to make a stroboscope test of the action on any diaphragm to determine just what its action was?

A. I don't know it by that term.

Q. What test would you make to determine the action of any diaphragm used in acoustics?

A. Do you mean by the use of some exact instruments?

Q. Yes.

A. I don't know. I don't know what I would use. I would have to make a selection. I have not anything in mind right now. What I have done was just to observe the best I could by my eye and by placing my hand on the vibrating cone [149] at various places and just judging by the feel of the thing. I can tell that it is vibrating. When I put my hand in various places it appears to be vibrating about the same amplitude everywhere.

Q. On all frequencies?

A. Well, I never detected any difference.

Q. Don't you realize, Mr. Fouts, that an entire cone on the higher frequencies could not move as a piston?

A. That depends upon the size of the cone.

Q. You don't know what the action is on the higher frequencies as compared with the lower frequencies, do you?

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A. I have stated it.

Q. And you claim that the cone moves as a piston on the higher frequencies?

A. I have told you over and over again that it did not.

Q. Then it does not move as a piston?

A. It is a good deal like taking an umbrella, you put it over you and you move it up and down slowly, I don't care what the amplitude is, you then move it as a piston. If you go on jerking it up and down and working it rapidly, the outer edges of the umbrella will tend to keep the same plane and the middle will go up and down. That is about how the cone will work.

Q. Is not that the same way that the diaphragm in the Pridham and Jensen patents will work, bearing in mind that the patents disclose a diagram of corrugations?

A. No, indeed; it is clamped around the edges, and it can not work at all like the umbrella I am talking about, even with slow amplitude or slow frequencies. The umbrella would go up and down as a piston. That thing could not move at all on the edges.

Q. Evidently you read some more literature last night, Mr. Fouts, [150] judging from the questions your counsel asked you this morning. I would like to have your definition of what causes blasting.

A. I will have to give you a couple of illustrations. I used to amuse myself as a boy by blowing

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on a cornet; frequently I would go to the piano and put down the loud pedal and give a short, sharp blast, say, on middle C, and then listen to the resonance coming out of that piano; I would have not only the tone that I had sounded, but I would have the octaves and the chords, etc.—a regular chord. That showed that those strings that were set in vibration were resounding to the original sound waves that I had sent out. The other day I was driving around in an automobile and I heard a sort of a rattle or a buzzing up in front; I could not locate it at first, but I found that the number plate up in the front of the machine was almost but not quite touching the part it was fastened to, and at a certain speed of the engine there would be enough vibration to set that number plate working and vibrating against the machine. I got out and pinched it up a little bit and there was no more noise. The point in that illustration is that I had gotten the engine vibration exactly to that point of natural frequency or resonance of that number plate and it set up the vibration. That is the way with a diaphragm.

Q. And do you call that blasting?

A. Blasting as applied to the number plate—no, I would not think of that in that connection.

Q. Do you know that blasting, as applied to sound reproducing diaphragms, has reference to any sort of a diaphragm that is not secured at its periphery, as in a sound-box or what you prefer to call a cone housing?

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A. No, I didn't know that. I don't know whether you do, or not.

Q. I do, yes.

A. Did you mean that it is applied to that only? If you mean that it is only applied to that I would certainly ques- [151] tion your understanding about it.

Q. The point you mentioned in your previous answer as regards periodicity—periodic vibration, everything has its own period of vibration?

A. Yes.

Q. And the cone has it, as well as the relatively small metal diaphragm?

A. With this distinction between those two structures: Where you take the metal diaphragm clamped about its edges and put it under a sort of a tension there, so that it is difficult to flex, and it has a quick return, when you get the frequency up to the natural periodicity of that diaphragm it is going to be set into vibrations of its own, it makes no difference whether it is a small diaphragm of a big one.

Q. Or whether it is made of paper or metal?

A. If you clamp a paper into a sound-box like you do the metal diaphragm, it will probably behave about the same way, except that it would be so very slight that I don't think the effect would be so great.

Q. It would not be there to the same degree, but it would be there, nevertheless, would it not?

A. I think it would be there nevertheless, but when you take the freely-floating cone, it does have natural periodicity, but it is so lightly and flexibly

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mounted that in all my experience with them I have never heard any of that blasting sound.

Q. I guess you have not seen all the cone types of loudspeakers on the market, because many of them omit this leather rim. Did you know that?

A. I never saw any that omitted it.

Q. That is the present practice. I guess that is all. No, I have one more question. In that sense you would not stress this freely-floating so much, would you, if the cone were all of one material—say stiff paper?

A. Oh, that is what you are getting at by that other structure you are speaking of, is it? [152] Undoubtedly instead of having that membranous piece hinged there they turned the cone out and clamped it, itself—is that what you mean?

Q. Yes, all one material of relatively stiff paper.

A. I never saw anything of the kind. I guess you are thinking of the Hopkins patent.

Q. Then you would not term that a freely-floating cone, would you, in the manner you have stressed here throughout your testimony?

A. No, it certainly does not float as freely as the other, and I would not call that a freely-floating cone.

Q. And having that in mind, you might want to modify some of the answers you have given here, might you not?

A. I don't think so. What, for instance?

Q. Well, where you stress the action of a freely-

(Testimony of Samuel E. Fouts.)

floating cone in order to do away with this blasting and this period of vibration, this natural period of vibration.

A. I think perhaps those cones which have this wide flaring base which are clamped rigidly in the frame structure around about there would have a greater tendency to the blast action than a freely-floating cone would have.

Q. Do you know anything about the action of a baffle?

A. What I have read about it. Since I became interested in this particular suit I have made some observations about it.

Q. Do you realize that the baffle—and that is used in connection with all of the defendant's devices, is it not?

A. As far as I know it is, yes.

Q. Do you realize that the baffle functions in the same manner as a horn?

A. I don't think it does.

Q. Why not?

A. That is going to lead us into quite a discussion here, but I think I can tell you why. The baffle in all the structures I have seen extends out at right angles to the axis [153] of the cone. I say all that I have seen—most of them are simply a part of the cabinet within which you mount your loudspeaker. That is not a horn, unless you would say it is a horn without any length whatever, that is, zero length. A horn is largely for the purpose of giving

(Testimony of Samuel E. Fouts.)

direction to the sound waves that are projected. It is a good deal like a speaking trumpet that we see used in athletic places. If you get in front of the trumpet you can hear what the announcer says; if you get off to one side of it, out of range of the waves that are sent out, you do not hear so well. That is one of the functions of a horn which a baffle does not have. The baffle is simply intended or used for the purpose of preventing the waves of compression on the front of the cone from passing around the edge of the cone, where they become neutralized by flowing into a vacuous space back there. It is understood that as the cone moves forward to compress the air it leaves a partial vacuum behind it. So we have in front a pressure above atmosphere, and at the back side we have a pressure below atmosphere. There is nothing separating these two regions except the cone. If the air were free to flow around the edge of the cone, the compressed air would simply be neutralized by flowing in the partial vacuum, and there would not be any sound waves sent out. That is the purpose of the baffle. It does not give any direction to the sound waves.

Q. You state that there is a compression of air on the front side of the cone, that is, on the concave side of the cone?

A. There is first a compression, then a rarefaction, then another compression. I was assuming an instant where we had a compression on the front of the cone and at the same instant there would be

(Testimony of Samuel E. Fouts.)

a region of low pressure immediately in back of the cone.

Q. Yesterday you were talking about free air with respect to the operation of the cone.

A. Yes, free air in front where you [154] would want the waves propagated.

Q. Didn't you just state there was a compression of free air on the front of the cone?

A. There is an instantaneous compression, and then an instantaneous rarefaction. Those are the waves you are sending out. Of course, the diaphragm has to send out the waves. The waves go out as free air without any obstruction.

Q. And that is true, also, of the enclosed type of sound box shown in the patents in suit, is it not?

A. No, sir.

Q. You have the instantaneous compression and rarefaction?

A. Yes, the instantaneous compression and rarefaction, but you do not have that free access to the open air that you do with the cone.

Re-direct Examination by Mr. Miller.

Q. On your cross-examination you were asked to look at the Lumiere patent 986,477, to see if he did not use the term "sound-box" in that patent. Will you please turn to the patent and refer to the language therein which uses the term "sound-box"?

A. I see one reference to one use of the term sound-box, in lines 27 and 28 on the first page. It is my recollection that there are other places in the patent where the same expression is used.

(Testimony of Samuel E. Fouts.)

Q. Will you read where that expression is used?

A. "The invention also relates to the sound-box in which said diaphragm is mounted."

I used to be considered a pretty good player of the cornet. I belonged to numerous bands and orchestras in my day. I have a piano. I play it some. That is, I used to. Since the development of the loud speakers and radios I have not used it a great [155] deal. I play the violin, but the cornet was my principal instrument. I am not now a member of a band; but I used to be a member of various bands. When I was in college I was a member of the college band and played the cornet. [156]

TESTIMONY OF J. A. BREID,

a witness on behalf of defendants.

Direct Examination by Mr. Miller:

I am a Patent Solicitor by profession and have been such for a good many years. I am familiar with Patent Office drawings and the method of reproducing or reading the same, and have been a draftsman for many years. I personally prepared this little blue book which is entitled "Pictorial Digest of the Art", or caused it to be prepared under my supervision. I laid out the work first from the various patents involved in the book, and one or two pictures which are not from patents, such

(Testimony of J. A. Breid.)

as the last one, the Atwater Kent cone speaker, and one other in here. These pictures were made by photographing the actual drawings of the various patents shown, and then they were colored. The only changes made at all were leaving of unnecessary lettering or reference characters which would confuse the issue. The pictures were enlarged in some cases from the original patents. All the coils were colored red. That was done in our office by my own draftsman and under by personal supervision. The magnets were colored blue. The diaphragms were colored green. The sound boxes, where they existed, were colored purple. The spacing rings, where they existed, were colored yellow. Suitable inscriptions were put at the bottom of each picture to show what the colors refer to.

The descriptions which are at the bottom of each picture were prepared by me. They are correct representations so far as I know. They are absolutely correct.

For instance, in the first case, here, the Siemens patent, I say, "Original invention of circular vibrating coil in circular magnetic air gap." My statement there that it is the original invention of the circular vibrating coil in a circular magnetic air gap is based on the fact that research showed nothing earlier than the Siemens patent, and therefore I felt that I was justified in saying that [157] that was the original invention.

The title page of the book I prepared as I pre-

(Testimony of J. A. Breid.)

pared the balance of the book. The title page, of course, speaks for itself, and states it to be merely a progressive schedule or chronological order of development of these various instruments, to show the gradual development of the vibrating coil and its application to various telephones of early development; also the advent of development of the spacing ring; also the advent or development of the pot magnet; the bringing of all the elements together by Lodge, pot magnet development, spacing ring development, floating coil development, and then, finally, the more recent patents which utilize these same elements. The pictures were selected from these various patents to show the chief steps in the development of the art. There were many other patents not shown in the book; these were simply the high points in the march of progress.

The statements contained on the title page are all correct so far as I am aware. I studied the art for over a month in preparing this book.

Cross-Examination by Mr. Loftus:

I am an associate of Mr. Miller, the counsel for defendants in this case. I am in his office; an employee of his office. Patents are given to me in my office to look over, to make a report. I made this while Mr. Miller was in New York.

All these pictures which relate to patents, except the one or two which do not relate to patents, such as the Atwater Kent cone speaker, and one or two

(Testimony of J. A. Breid.)

others, and with the exception of this one on 1913, the second picture of the Johnsen patent, they are actual photographs of the actual drawings in the patents. In the case of the Johnsen patent, it is a combination of two figures, actually [158] photographed from the Johnsen patents, and one put above the other. There has not been the slightest change of proportion or of size. The coloring matter on these pictures is water color, put over the parts by my man, and I watched him to see that nothing would be covered up that would distort anything or in any way carry a false impression. They were colored so that the Court could clearly see the red coil, the blue magnet, the yellow spacing ring, the purple sounding box, etc. They are not drawings. They are photographs of the drawings of the patents.

Q. Directing your attention to page 1899 as it is marked here in my copy of this little blue book, do you find anything in the British Lodge patent, at all like the figure shown there on the left-hand side of said page?

A. Yes, that left-hand figure was photographed from Fig. 5 of the Lodge British patent. It is an actual photograph colored up.

Q. Why didn't you photograph the entire figure?

A. Because we were only interested in showing the spacing plate and the circular magnetic gap. That is what this particular page was laid out for, to show that particular application of the spacing

(Testimony of J. A. Breid.)

ring secured to the bottom of the outer pole plate holding the central magnet in perfect spaced relation, precisely as it is in the plaintiff's loudspeaker patents, or telephone patents, rather.

Q. You did not consider it necessary to bring out the fact that this Fig. 5 of the Lodge British patent was a bi-polar instrument, and that the member marked F was for the purpose of serving as a shelf or vertical support for the top plate; is that correct?

A. No, that is not correct. It was put here for the purpose of showing the difference in that type of spacing ring as against the one shown in Fig. 5 in the Lodge article appearing on the right. In the Lodge article he said, as Judge Fouts pointed [159] out this morning, that he uses the spacing ring F in all the different figures. This figure was put here to show that type of spacing ring secured to the under part of the pole plate as against the other type in the figure to the right which extends across the cylinder or the inside of the pot and spaces the pole exactly like the third patent in suit. This was to show the spacing ring of the second patent in suit which Lodge said could be used everywhere and also showed the spacing ring of the third patent in suit. That is the only reason it was put there.

Q. In the British Lodge patent, where he shows a single central pole, as in Fig. 7, you do not find any spacing ring, do you?

A. I have not the Lodge patent before me. I am only testifying as to this book. This book selected

(Testimony of J. A. Breid.)

Fig. 5 to show that type of spacing ring which was secured to the bottom of the pole piece to show that Lodge had shown both types of spacing ring—both types which are shown in the plaintiff's structure.

Q. I find one here September, 1925; that is not taken from a patent, is it?

A. September, 1925, that is the date upon which the event occurred; that is, that is the Radio Corporation speaker 104. This particular picture is a picture of Radio Corporation speaker 104, which appeared on the market in September, 1925. As these various pictures here have the date indicated by the year, that is the date of their appearance on the stage which we are now enacting.

Q. But my question is whether or not that was a photograph taken from a patent.

A. No, that is not. There are two or three here which are drawings of the actual article. That is a drawing of the article. That is also true of the last two pictures which are the two forms of Atwater Kent speaker. They are also showings from the actual article. [160]

Q. You made that drawing?

A. I had the drawing made; that is, this particular drawing was first photographed from an exhibit which was used in the Thompson Case and——

Q. Don't mention that. Mr. Miller doesn't want that Thompson case mentioned, as I understand it.

A. Rather than redrawing this whole thing, and

(Testimony of J. A. Breid.)

since the drawing was once made, I had a photograph made of it. I had my draftsman carefully measure the R.C.A. speaker 104 and check these figures. I personally marked the word "magnet winding" on there. It looks like my writing, and I believe I marked it on there.

Q. And then you used your own interpretation of these patents in coloring them, as I understand it?

A. No, there is no interpretation. All the magnets have been colored blue; all the coils have been colored red; all the sound boxes have been colored purple; all the diaphragms have been colored green. There is no interpretation whatever. There is no change in the drawing, not even a slight change. They are photographs of the patent drawings and are absolutely correct.

Q. For example, if there is not any of your own interpretation here let me call your attention to the page marked 1888, which is a figure of the Mather patent. You do not find anything in the Mather patent pertaining to spacing rings, do you?

A. You see that upper disc of the coil attaching the inner pole to the outer cylinder and holding it in spaced relation? It absolutely is a spacing disc. I have the right to color something which manifestly is a spacing disc.

Q. You know that that is the end of the spool, don't you?

A. It fits tightly within the article exactly the

(Testimony of J. A. Breid.)

same as the last patent the claim of which you withdrew.

Q. You know it is the practice to wind these coils upon [161] a spool and that the ends of the spool fit loosely within the casing so that they may be dropped in and removed readily; is that not correct?

A. No, that is not correct, it is incorrect. For instance, in Lodge, of 1899, we see he fits the spool tightly and spaces the poles thereby. In the Mather patent he did the same. In the Magnavox patent, the last one, which was withdrawn, Claim 8, or Claim 9 shows exactly the same thing. They are absolutely identical. Therefore, it is not the practice, you see.

Q. Do you mean to say that these coils are driven in there by force?

A. I don't say they are driven in, I say that the head at the end of the coil is made to fit within the center and hold it to the center pole piece spaced exactly as in the Pridham and Jensen patent showing the same thing.

I don't know what material the head of the spool is made of. It could be anything. It can be wood; it can be any stiff material; whatever it is it functions precisely the same. I have followed drafting and engineering for many years. I have many patents of my own, and I know what a drawing is and I know what it means when I look at it.

By stipulation a copy of the deposition of Paul E. Sabine, taken in the case of Magnavox v. Hart & Reno, No. 2534, was offered in evidence, said deposition being as follows: [162]

DEPOSITION OF PAUL E. SABINE,

a witness on behalf of Defendants.

Sept. 29, 1931.

(Mr. WILKINSON: Messrs. Loftus, O'Connor and Kranz, representing the plaintiff, accompanied by Dr. Paul E. Sabine and counsel for defendants to the Stewart-Warner Corporation Radio Laboratory, where the Lodge loud speaker was operated by Mr. George M. Holly.)

Direct Examination by Mr. Wilkinson:

My name is Paul E. Sabine; I am 52 years old; I live in Geneva, Illinois, and am a research and consulting physicist by occupation. I am employed by the River Bank Laboratories, which is a company incorporated not for profit under the laws of Illinois and devoted to the study of problems in acoustics.

My training and experience tending to qualify me to explain to the Court acoustical devices and their operation, is this: I am a graduate of Harvard University. I have taken my Doctor's degree in physics. I was for two years assistant professor in physics at the Case School of Applied Science. For

(Deposition of Paul E. Sabine.)

the last 12 years I have been director of acoustical research at the River Bank Laboratories. I am a member of the American Physics Society and the Acoustical Society of America. I have devoted 12 years to research on problems in sound. I am the author of numerous technical papers on acoustical questions and have had 12 years' experience as a consultant.

I have read Pridham and Jensen patents Nos. 1,448,279 and 1,579,392, the patents in suit. I understand the construction and operation of the electrodynamic receivers illustrated and described in said patents. The term "sound box" is used in the said two patents. That term is well known in the acoustical art. [163] The term "sound box" arose in connection with the development of the phonograph and as employed in the phonograph art it refers to a small cylindrical box, one side of which is the diaphragm or other moving vibrating member, the other side being closed except for an opening usually terminating with a tubular extension to which the horn of the phonograph is attached. This nomenclature has subsequently in the development of loud speakers come to be used quite generally with a similar meaning except in the loud speaker the diaphragm is operated, not by a needle as in the phonograph, but by the electrical currents which are supplied to the loud speaker.

Q. Can you refer to any books of reference or

(Deposition of Paul E. Sabine.)

authorities to support your definition of a sound box?

A. Yes. The International Encyclopedia, the 1918 edition, in the article on Phonographs pictures substantially the construction which I have described. This is Volume XVIII, page 544. There are two figures here showing sound boxes and the diamond point of the Edison disk machine and soundbox and needle of the Victor machine.

In further support of that statement you will find in Dayton C. Miller's Science of Musical Sounds, published in 1916 by MacMillan Company, a reference to the diaphragm of the sound box of a phonograph.

The last edition of the Encyclopedia Brittanica, in the article on Gramophones,—I have not the page, but it is in the 14th edition, 1929—it states that by 1905 a type of sound box has been evolved, the use of which has persisted for 20 years.

In the current literature on the subject of the reproduction of speech you will find frequent references to the sound box as used in loud speaking devices with horns. [164]

C. R. Hanna, in the Journals of the Acoustical Society of America, October, 1930, refers to loud speaker units in sound boxes for use with horns.

Maxfield and Harrison, in the Bell System Technical Journal for July, 1926, use the term "sound box" and refer to the air chamber which it encloses used in connection with the development of the Orthophonic phonograph.

(Deposition of Paul E. Sabine.)

In the Journal of the American Institute of Electrical Engineers, 1924, Hanna and Slepian have an article in which they discuss the operation of the horn and the part which the sound box plays in the reproduction by loud speaking devices.

Q.10 How does a sound box operate acoustically?

A. The sound box is a small almost wholly enclosed chamber. As I have stated, one side of it is connected with the member which produces vibrations of the diaphragm. One side of it is the diaphragm. And the movements of the diaphragm back and forth alternately contract and expand the volume of this chamber and the enclosed air and these volume changes are accompanied by pressure changes in the enclosed air. The smaller the volume of the box the greater will be the pressure change for a given displacement of the diaphragm.

Q.11 When a horn is used in connection with the sound box what is the resulting acoustical operation?

A. The large pressure changes in the sound box would not necessarily result in any considerable volume of sound. In order to utilize these large pressure changes as sound a considerable volume of air has to be set into vibration and the air cavity or the air enclosed in the sound box which is subjected to these large pressure changes connects directly through the throat of the horn with a larger volume of air with an expanding cross-section as the horn expands and these large pressure

(Deposition of Paul E. Sabine.)

changes operate directly on the air enclosed in the horn to produce vibrations in that column of air. This column of air may be vibrated as a whole, in which case the horn is emitting its fundamental tone, or it may vibrate in parts. As the diaphragm advances, decreasing the volume of the air enclosed in the sound box, it sets up a pulse of condensation in the air and the air is forced out under pressure into the horn. This movement is transferred through the expanding section of the horn and is finally radiated from the mouth of the horn as sound over a large area. In other words, the combination of sound box and horn act as a means of acoustically coupling the stiff, rather small, dense diaphragm, with a large volume of much lighter and much less dense air at the mouth of the horn. The combination serves as a means of acoustically coupling and corresponds to the impedance matching in electrical circuits where you want to transfer energy of oscillating current from one part of that circuit to another most efficiently. The sound box and horn increase the efficiency of the diaphragm as a sound producer.

In the said Pridham and Jensen patents the term "sound box" is used in the sense in which I have just defined it and I think it is properly used.

Q.13 Mr. Edwin S. Pridham, one of the joint patentees of the two patents in suit, in his deposition in this case stated on page 15 that in the case of loud speakers the term "sound box" "can be

(Deposition of Paul E. Sabine.)

used as a supporting medium or enclosure to support the diaphragm. There are many definitions of the word 'sound box.' It is not restricted to any particular or definite type of apparatus." Do you agree with the said statements of Mr. Pridham? [165]

A. I do not agree with Mr. Pridham on that in the light of the quotations which I have already made or the authorities which I have already cited.

The term "sound box" does refer specifically to an enclosure and, moreover, engineers recognize the fact that this enclosure does form and the size of the opening does play an important acoustical function in the operation of the loud speaker device. So that any frame that holds the diaphragm cannot be properly spoken of as a sound box unless it fulfills the functions which I have already indicated as the function of the sound box.

I think the current literature bears that out, as well as the literature of the phonograph art in general.

Q.14 Mr. Pridham in his deposition referred to Lumiere's patent No. 986,477 to support his statement that a sound box may be merely a supporting frame. Do you regard that term "sound box" as correctly used in the said Lumiere patent?

A. Can you point out to me just what he calls the sound box there?

Q.15 You will notice on page 1 of the specifica-

(Deposition of Paul E. Sabine.)

tion of the said Lumiere patent, lines 27 and 28, the following statement occurs:

> "The invention also relates to the sound box in which said diaphragm is mounted."

Referring to the drawings of the said patent in which the part designated as 13 is merely a spider, do you regard the term "sound box" as properly applicable to that structure, for instance, as shown in Figure 7 of the said patent?

A. What is disclosed there does not, in my opinion, come under the commonly accepted usage as to the meaning of the term "sound box". It certainly has no functional purpose from the [166] standpoint of sound and is not a box in any sense of the word, so that I think the term "sound box" as used in that patent is clearly a misnomer.

Q.16 Please explain the cooperative relation between the sound box diaphragm and coil attached thereto in the electrodynamic receivers illustrated and described in the Pridham and Jensen patents in suit.

A. Referring to Figure 2 of the Pridham and Jensen patent No. 1,448,279, we have disclosed a sound box 2, which is a metal box with a tubular extension, one side of which is a corrugated diaphragm, and to the center of this diaphragm, attached by a stud, is a small conical frame that carries a coil of wire. This coil of wire is wound on some sort of a ring and this is placed in the

(Deposition of Paul E. Sabine.)

annular space between the pole pieces of a magnet consisting of an outer shell of magnetizable material with a centrally mounted core. Around this centrally mounted core are turns of wire and, according to the description in the specification, a direct current is passed through this magnetizing coil, thus setting up a strong magnetic field in the annular air gap between the centrally mounted pole and the top of this soft iron casing which acts as the opposite pole of the electromagnet. The alternate currents passing through this coil of wire, the small coil, which I will call the voice coil, react with the magnetic field, producing a force on the coil of wire. The direction of this force is dependent on the direction in which the current flows. The alternations of the current in the voice coil produce this alternating force on the coil and this being rigidly attached to the diaphragm causes the diaphragm to move up and down, corresponding to the alternations or the oscillations of the electric current through the voice coil. [167] The motion of the diaphragm up and down varies the pressure in the sound box and these pressure variations, as I have already stated, will be transmitted to the air column enclosed by the horn which communicates with the sound box.

Q.17 Does the resiliency of the diaphragm and the fact that its fluctuations vary the air pressure in the sound box react in any way upon the coil in its movement?

(Deposition of Paul E. Sabine.)

A. The resiliency of the diaphragm furnishes a restoring force when the diaphragm is displaced and this restoring force tends to bring the diaphragm back to its undistorted or undisturbed position, so that the resiliency or the elasticity of the diaphragm does react on the coil; that is, it serves as one of the forces against which the oscillating electric current is doing work.

Q.18 How about the compression of the air in the sound box incident to the fluctuations of the diaphragm; does that have any reaction on the coil?

A. Yes, the reaction of the enclosed air on the diaphragm also forms part of the elastic restoring force which is exerted to restore the coil to its undisturbed position. The smaller that cavity, I may add, the greater is that force for a given displacement.

Q.19 If the horn were applied to the sound box of the electrodynamic receivers illustrated and described in the said Pridham and Jensen patents what would be the acoustical operative relation between the sound box and the horn?

A. The pressure changes set up in the sound box without the horn would simply be relieved by the flow of air in and out of the opening of the sound box. This flow in and out might take place, or does take place, without setting up acoustical [168] waves over any considerable volume of air. When you put a horn at the end of that tubular extension

(Deposition of Paul E. Sabine.)

the surge of air in and out of the sound box sets up a corresponding motion of the air at the throat of the horn and this motion is communicated through the expanding section of the horn to the mouth and we have radiated from the mouth of the horn sound over a large area; that is to say, the total amount of sound that is drawn from the loud speaking device for a given electrical input is increased by the combined action of the sound box and horn.

Q.20 Have you seen and listened to the operation of an electrodynamic receiver made in substantial accordance with the disclosures of Pridham and Jensen patent No. 1,579,392 when used in conjunction with a horn?

A. Yes.

Q.21 I call your attention to a device and ask you to examine same and state whether or not you can identify it.

A. That is the device which I heard at the Stewart-Warner Laboratories one day last week.

(Mr. WILKINSON: The device identified by the witness bears a name plate with the following inscription: "Radio Magnavox Type RS Mod. D No. 150971 The Magnavox Co., Oakland, California," and the same is offered in evidence as defendants' Exhibit 1.)

Q.22 I call your attention to a copy of plaintiff's exhibit C, which illustrates the defendants' loud speaker complained of in this suit, and ask

(Deposition of Paul E. Sabine.)

you whether you understand the construction and operation of it.

A. I have examined and listened to the operation of a loud speaker substantially conforming to that illustrated in the said drawing, plaintiff's Exhibit C. That is the device that I heard. [169]

(Mr. WILKINSON: The device identified by the witness bears a name plate having on it the inscription "Stewart-Warner Made in U. S. A. Dynamic Reproducer Model 445-A" and is offered in evidence as Def.'s Exhibit 2.)

Q.25 Does the said loud speaker as illustrated in the said drawing, Plff's. Ex. C, and exemplified by Def's. Ex. 1 comprise a sound box?

A. No, I should say not.

Q.26 Please give your reason for your answer.

A. Structurally I see no construction that could be properly termed a sound box. Acoustically there is nothing in this loud speaker that performs the function of a sound box in conjunction with a horn in loud speaking devices. In this case the vibration of the cone diaphragm is transmitted directly to the free air. In the case of the sound box and horn, as already indicated, there is a coupling between the diaphragm, an acoustical coupling, by way of the sound box and the horn, between the vibrating member and the free atmosphere.

Q.27 Please compare the construction and operation of a cone diaphragm such as is present in de-

(Deposition of Paul E. Sabine.)

fendants' loud speaker with a sound box diaphragm such as illustrated and described in the two Pridham and Jensen patents in suit.

A. Both devices, of course, are operated by the reaction between an alternating current and a magnetic field. In other words, they are both of the electrodynamic type of sound reproducer.

In the Pridham and Jensen device the moving coil is attached to a small, relatively stiff, diaphragm rigidly clamped at its periphery and this diaphragm constitutes one side of the sound box. The small amplitude of the pressure vibrations of the [170] diaphragm in the Pridham and Jensen device is converted into larger amplitude vibrations over a large area throughout the medium of the sound box and horn.

In the cone type the vibrating member is of light construction flexibly mounted and held at its periphery and is thus relatively free from elastic restraints. Its vibrations are correspondingly greater and these vibrations are transmitted directly to the free atmosphere without the intervention of the coupling system which comprises the sound box and horn.

Q. 28 Please describe the operation of defendants' loud speaker with particular reference to the cooperative relation between the coil and the cone diaphragm, and in doing so please compare such cooperative relation with that which exists

(Deposition of Paul E. Sabine.)

between the coil and sound box diaphragm in the receivers illustrated and described in the two Pridham patents in suit when they are provided with a horn.

A. On account of its shape, the cone in the cone type of loud speaker tends to move as a whole. The force on the diaphragm is exerted at the vortex of the cone, so that there is less tendency for the cone, considered as a diaphragm, when in vibration to break up into segments.

The elastic restraints are small. Therefore, the thing which determines the amplitude of the cone largely is the mass of the cone. It is an inertia controlled device. It can be shown mathematically that under the influence of inertia alone the amplitude of motion of a body will vary inversely as the square of the frequency for a given value of the driving force. This means that an inertia controlled device will radiate more powerfully the low frequencies than would a device in which the elasticity is the controlling factor. As a result the cone type [171] of speaker, as is well known, is much more efficient in radiating the low frequency portion of the sound spectrum, and this is one of the decided advantages of the cone type of speaker.

In the case of the small clamped diaphragm of the Pridham and Jensen type, the elastic restoring force is not small in comparison with the part played by the inertia of the diaphragm and the coil. Therefore, the Pridham and Jensen type with the

(Deposition of Paul E. Sabine.)

small diaphragm clamped at its edges has natural frequencies to which it responds more vigorously than it responds to other frequencies, with resulting distortion in the sound which it produces. For a diaphragm such as is shown in the defendants' device these natural frequencies will lie perhaps somewhere near the middle of the frequency range, and we find that the response of this type of speaker is much greater to the middle frequencies than it is to the extremely low frequencies. That is the essential difference between the cone type and the clamped diaphragm sound box type.

In the clamped diaphragm type you have a dense diaphragm creating large pressure changes in a small air cavity.

In the cone type you have large amplitudes transmitted directly to the air.

In order to compensate in a measure for the distortion produced by the diaphragm and also to increase the efficiency of the small clamped diaphragm type a horn is added. If this horn is of only moderate length, even though it is well designed, it will have its own natural frequencies to which it will respond more vigorously than to other frequencies. The result with a horn of moderate length used is it adds further distortion. In order to have as faithful reproduction with a small diaphagm as you have with the larger cone type a long horn is necessary. [172] In the Orthophonic phonograph the improvement they effect there calls

(Deposition of Paul E. Sabine.)

for a horn something like 85 inches in length, and that was an essential part of the Orthophonic improvement.

Q. 29 You have said that in the sound box diaphragm as disclosed in the Pridham and Jensen patents the resiliency of the diaphragm which is directly connected to the coil and the compression of the air in the sound box react upon the coil. Is the coil which operates the cone in the defendants' loud speaker subject to such reactions?

A. There would be no reaction due to pressure changes set up in a small cavity in the cone type, but there would be a reaction due to radiation of sound from that cone. In other words, the radiation of sound also puts a load on the moving coil.

Q. 31 How would the load put upon the moving coil by the resilience of the diaphragm compare with any load that may be put upon the coil in the defendants' loud speaker, as you point out, in which the cone is mounted for substantially bodily movement.

A. I don't know that I can answer that question, Mr. Wilkinson, right off the bat.

In each case you have a reaction due to the fact that you are working against a force, the coil is working against a force, and as to the relative magnitude of those two reactions and the part that is to be ascribed in one case to inertia and in the other case to elasticity is something that I am not prepared to answer.

(Deposition of Paul E. Sabine.)

includes a stationary and fixed magnetic field with a coil of wire which is free to move. The coil experiences alternating forces coinciding with the alternations of the electrical current and movements are set up in it which are communicated to a diaphragm to which the coil is attached. The first method is ordinarily called the electromagnetic method and the second method the electrodynamic.

In 1887 Hertz in Germany discovered the fact that electromagnetic disturbances set up waves in free space and it was early recognized that this was a possible means of communication.

One of the most important problems in the development of wireless communication was the production of devices that were sufficiently sensitive to respond to the feeble electrical impulses. Oliver Lodge in England was one of the pioneers in this field and on December 8, 1898, he delivered a paper before the Institute of Electrical Engineers in London on the subject of improvements in magnetic space telegraphy. This paper is reported in the Journal of the Institute and it is also reported more or less identically in the other publications cited in the question. [175]

It is well to point out that Lodge specifically makes no claims of discovery in principle, but simply claims to have improved devices which were already known for amplifying the effects of weak electrical impulses.

Lodge was primarily interested, of course, in

(Deposition of Paul E. Sabine.)

securing extremely sensitive devices and he secured increased sensitivity in three distinct ways, which he outlines quite in detail in his paper. The first was by syntonically operated devices. Two devices operate syntonically when they are tuned to the same frequencies. He used the term "to operate syntonically" to cover electrical and mechanical tuning and he shows a number of telephonic devices in which he secured increased sensitivity by tuning the transmitting and receiving devices to the same pitch.

The second general type of device which he describes are devices in which the tremors excited in a moving coil placed in a fixed magnetic field are transmitted to a movable plate or sound board. Lodge used to term it a sound board.

Then the third device he called the magnifying telephone, which will be described in detail a little later.

The syntonic devices were usually tuning forks with means for actuating the tuning forks similar to the moving coil method of which I have already spoken.

Now in the vibrating coil telephone with sound board the first type which he describes is given on page 837 in the Institute of Electrical Engineers paper. I will also refer to the other figure, which is Figure 4, page 367, in The Electrician. You will note that those two drawings are not identical. In The Electrician article he shows, for example, leads

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extending to the coil C and a different lettering. The devices, however, are essentially the same. In that device we have an electromagnet [176] with the like poles placed close together leaving a gap in which the moving coil mounted on a stretched wire is placed. The presence of the two unlike poles close together give what is substantially a radial field through the coil, so that when any current passes through the coil there will be a force exerted on the coil. This taut wire which supports the coil is attached to the center of the diaphragm of a sound board marked E and the operation is essentially that of the ordinary electrodynamic type of receiver.

Lodge does not have so very much to say about that device and presumably it was not very efficient because the field through the coil would be weak, but it operated, obviously.

The next device which he calls attention to is shown in Fig. 7 of the Electrical Institute paper and in Fig. 5 of The Electrician. Fig. 5 is also on page 367. There again you will notice that in The Electrician illustration the details of construction and the dimensions are shown and it is to be presumed that this is a working drawing of the device intended. There we have a cylindrical magnetic shell enclosing a central pole piece with a magnetizing coil wound around the central pole piece. The top of the cylindrical shell is also of magnetic material and serves as one pole of the electro magnet. There is a hole considerably larger than the central pole piece in the center of the top of the case and in the

(Deposition of Paul E. Sabine.)

annular space surrounding the central pole piece there is shown a coil of wire which is attached to a wooden disk. This wooden disk is supported on three supports located, not at the periphery of the disk, but on a nodal circle of this disk. Lodge states that so mounted it behaves as a circular sort of harmonicon reed. [177]

In Fig. 8, on page 839, of the Institute of Electrical Engineers article and in Fig. 12, page 404 of The Electrician, he shows a still further form, and this is the same as Fig. 1 in the Lodge patent No. 9712. We find in his description of this the coil is attached to a light wooden tripod or stiff cone, which in turn is attached to a large sound board as indicated in the drawing.

These three forms are typical of the vibrating coil and sound board type of device which Lodge developed.

Then he further discloses another device which he calls a magnifying telephone, in which we have the moving coil in the magnetic field as in the other devices described, and this is attached to the diaphragm of a carbon microphone. This device was to be used as an amplifier. The carbon microphone was attached in series with a local battery and the signals which were received were sent through the suspended coil which was set into action by their action, thus varying the pressure on the carbon granules of the mocrophone, producing variations in the local circuit.

All of these devices were intended as sensitive devices for picking up electrical signals, but Lodge

(Deposition of Paul E. Sabine.)

clearly recognized that they had other uses. For example, on page 846 of the Institute of Electrical Engineers' article he states:

> "The last telephone of the series has been so far represented as one of ordinary pattern, but it is obvious that the vibrating coil attached to a wooden sound board may be employed; and, further, that a combination of such sound board telephones may have an important application to the human voice and the acoustics of buildings—a different subject into which I will not now further go."

He is referring here to the series shown in Figure 12, pages 843, in which is represented two of his magnifying microphones M_1 and M_2 terminated by a loud speaker III.

In the magnifying telephone Lodge was making use of the pressure variations set up by the oscillating currents to change [178] the resistance of his microphones. That Lodge contemplated the use of his devices as loud speaking instruments is shown by the reference, page 5, line 31, where he says:

> "No. III is a loud-speaking telephone consisting of a vibratory coil and sound board, like Figure 1."

He also states, line 5 of page 5 of patent No. 9712:

> "I may use this plan of magnification as a call, or as a receiver in magnetic telegraphy,

(Deposition of Paul E. Sabine.)

> but it is obviously applicable to other useful purposes such as magnifying a speaker's voice by distributing it to various parts of a large hall."

In the Institute of Electrical Engineers paper it is obvious that Lodge showed certain demonstrations which are not referred to specifically in the paper.

On page 892, in the discussion which followed at the next meeting of the Institute of Electrical Engineers, Mr. Evershed states:

> "It is clear from what we all heard of Dr. Lodge's telephones, that they are at least equal to the ordinary patterns as speech instruments, and electrically they are infinitely superior."

So that in this development of Lodge's we have an anticipation of the modern electrodynamic speaker of the moving coil type. If in Fig. 5 of The Electrician article we substitute for the wooden disk a light paper cone, we have a device corresponding in principle and in construction to the cone type of loud speaker.

The sounding board in all of these moving coil devices which Lodge disclosed is simply a device by which tremors of the moving coil are transmitted to the large area of a flexible body from which they are radiated as sound. In everything except the possession of vacuum tubes it would appear that Lodge anticipated the modern methods of amplifying speech reproduction. [179]

(Deposition of Paul E. Sabine.)

(Mr. WILKINSON: Photostatic copies of pages 246 to 248, Vol. XXVII of the March 2, 1899, edition of The Electrical Engineer are offered in evidence as Defs'. Ex. 4. Photostatic copies of pages 269 to 271 of the Dec. 16, 1898, edition; pages 305 to 309 of the Dec. 23, 1898, edition; pages 366 and 367 of the Jan. 6, 1899, edition; and pages 402 to 405 of the Jan. 13, 1899, edition of The Electrician are offered in evidence as Defs'. Ex. 5. Photostatic copies of pages 798 to 922 of The Institute of Electrical Engineers, Vol. XXVII, No. 565, are offered in evidence as Defs'. Ex. 6.)

I have seen a device like that illustrated in Fig. 5, page 367 of The Electrician, and Fig. 5, page 247 of The Electrical Engineer, and described in said publications. That is the device I saw and heard.

(Mr. WILKINSON: The said device identified by the witness is offered in evidence as Defs'. Ex. 7.)

I have listened to the said device in operation. It performed as a loud speaker fitted to a radio set of the Stewart-Warner type. It produced speech that could be easily heard at a distance of something in the neighborhood of 20 to 25 feet and understood. The enunciation was good. It also produced music in which the various types of musical instruments could be distinguished and it operates as a loud speaker.

Q. 38 When the said device was operated in your

(Deposition of Paul E. Sabine.)

presence in what way were the sound waves generated for reproduction maintained?

A. This device was operated both as the loud speaker of a radio receiver and also as the loud speaker of an electrical phonograph with vacuum tube amplifier.

Q. 39 Will you please compare the said loud speaker as embodied in the said Defs'. Ex. 7 and as illustrated in the Lodge articles to [180] which you have referred with defendants' loud speaker and also with the electrodynamic receivers disclosed in the two Pridham patents in suit? In doing so, if you desire, you may refer to an enlarged photograph of Fig. 5 appearing in the said two publications.

A. The following features are the same in all three devices:

1. A shell composed of magnetizable material, a central pole piece, a magnetizing coil, a circular pole piece constituting the top of the shell with a hole of larger diameter than the diameter of the central pole piece, thus producing an annular air gap between the central pole piece and the top of the magnetizing shell.

2. A magnetizing coil supplied with direct current which excites the electromagnet described.

3. A light coil suspended in the magnetic field in the annular gap.

In the Pridham and Jensen device the light coil is rigidly attached to a corrugated metal diaphragm

(Deposition of Paul E. Sabine.)

rigidly clamped at its edges, which diaphragm constitutes one side of the sound box of the Pridham and Jensen electrodynamic receiver.

In the Stewart-Warner free edge cone the coil is attached to the apex of the cone, said cone being flexibly attached at its periphery to an open frame construction.

Q. 40 Will you also compare the operation of the said Lodge loud speaker with the operation of defendants' loud speaker and with the operation of the electrodynamic receivers disclosed in the Pridham patents in suit when they are supplied with horns?

A. The action of the Lodge device in the production of sound waves is essentially the same as that of the cone type of speaker. Substitute for the wooden disk E of the Lodge device the fiber cone flexibly attached at its periphery of the defendants' device and the two constructions would be practically the same, acoustically considered. [181]

In the Pridham and Jensen device the moving coil is attached to a metal diaphragm rigidly clamped at its circumference, which diaphragm constitutes one side of the sound box. In the Lodge and Stewart-Warner devices sound is radiated directly from the moving member which is attached to the coil. In the Pridham and Jensen device sound is radiated from the mouth of the horn used in connection therewith.

(Deposition of Paul E. Sabine.)

Q. 41 You have referred to the substitution of a cone for the wooden diaphragm E of the Lodge device. Was such substitution made in your presence in Defs'. Ex. 7?

A. It was and I heard the device operate after such substitution had been made.

Q. 43 What were the results?

A. When the cone of the defendants' loud speaker was substituted for the wooden disk the improvement was very marked both in the volume of sound produced and in the quality. In fact, so operated the Lodge device might well be mistaken for a modern loud speaker of the cone type. This is the device that was clamped to the Lodge device in the place of the wooden disk.

Mr. WILKINSON: The cone device identified by the witness is offered in evidence as Defs'. Ex. 8.

Q. 45 I notice that in the publication of the Lodge paper in the Institute of Electrical Engineers, page 840, the following statement is made:

> "The loading, however, would spoil all this damping, so that considered as a syntonic receiver it was not successful."

Will you please explain what you understand to have been meant by the statement that "as a syntonic receiver it was not successful"?

A. You must bear in mind what Lodge was after. In the early parts of this paper he speaks of increasing the sensitivity [182] of his receiving devices by syntony or tuning. At this particular stage

(Deposition of Paul E. Sabine.)

he was looking for an extremely sensitive tuned "pick-up." The sharpness of tuning of a system depends upon the damping. Highly damped systems cannot be sharply tuned, that is, tuned so that they will respond much more vigorously to a given frequency than to other frequencies. The loading of the wooden disk with the heavy coil increases the damping and decreased the value of the device for Lodge's immediate purpose. This does not imply that the device was not successful as a loud speaker telephone receiver for mixed frequencies.

Q. 45 If, as stated by Dr. Lodge in the quotation made in my preceding question, the device he referred to was not successful as a syntonic receiver, what, if any, bearing would that have upon the success of the device as a loud speaker?

A. In a loud speaker what is desired for good quality is uniform response to all frequencies. In a syntonic receiver what Lodge wanted was a device that would respond to a single frequency. Speaking generally, a syntonic receiver would not show good quality for speech and music since it would give preponderance to the frequency for which it was tuned.

Mr. WILKINSON: The enlarged photograph of Fig. 5 from The Electrical Engineer and The Electrician is offered in evidence as Defs'. Ex. 9. [183]

Cross-Examination by Mr. Loftus:

The use of the term "sound-box" originated in the phonograph art, but current literature on loud

(Deposition of Paul E. Sabine.)

speakers indicates that the term "sound-box" has been applied with the same significance when dealing with loud speaking devices not strictly phonographs. The type of sound-box used in a loud speaker would serve the same purpose acoustically as in the case of phonographs. My actual experience with phonographs and loud speakers is that I have had to use loud speakers in my acoustical research as sources of sound. I have had occasion to use the Magnavox device with special modifications for what Lodge would call the syntonic device. Most of my work has been in the line of architectural acoustics, which involve measurements of intensity by various means, and problems associated with sound in rooms and in buildings in general. Primarily it has nothing to do with the problems in connection with designs of instruments for generating sound. My attention was first called to the Lodge loud speaker in connection with the suit of The Magnavox Company v. Thompson. That was a matter of just a few years ago. I had been familiar with the Magnavox loud speakers for a matter of several years prior to that time. In the case of the Pridham and Jensen patents there is no flexible annular ring between the point at which it is clamped and the main body of the vibrating member. It is all one. I have seen Stewart-Warner loud speakers where the diaphragm is all of the same material. Such diaphragms would not be as rigidly clamped as the diaphragm shown in the Pridham and Jensen patents because it is a

(Deposition of Paul E. Sabine.)

larger diaphragm in the first place, and in the second place it is of less rigid material. I do not find any particular material specified in the Pridham and Jensen patents, but in the Pridham and Jensen devices which I have seen the [184] diaphragm is a metallic material. It is possible, perhaps, to make such metallic diaphragms just as flexible as the paper cone. In comparing the operation of the cone-type diaphragm as exhibited in the Stewart-Warner loud speaker with what I have termed the sound box and horn, it is not simply a question of the volume of air that is placed in motion or disturbed. The amplitude of the motion would also enter into the intensity of the sound, I think. The larger the diaphragm the less amplitude of motion is required to produce a given total of acoustical power.

A baffle is a large reflecting surface set up around the vibrating member to prevent the passage of pressures or the flow of the pressures from the front of the vibrating member back to the rear and thus neutralizing the action and reducing the acoustical efficiency. To a certain extent the baffle increases the intensity of the sounds, and that is the purpose of a horn also.

The volume of sound given off by Def's. Ex. 7 was much less than in the case of Def's. Ex. 2. The power supplied to the magnetizing coil in the case of Def's. Ex. 2 was 4½ watts and in the case of Def's. Ex. 7 was 18 watts. It should be admitted,

(Deposition of Paul E. Sabine.)

certainly, that the efficiency of this Number 2 device as a sound producer, when you take the ratio of the energy put out as sound to the energy of the electrical current which feeds it, is much greater than the efficiency of Number 7.

No. 7 was built according to Lodge's specification as nearly as could be determined from the figures given in Fig. 5., the measurements given in Fig. 5 of The Electrician paper, and in order to energize that field of No. 7 with that sized wire it requires more energy than to energize the field of No. 2. That is due in part to the fact that Lodge shows such an extremely wide air gap between the pole pieces. The width of that gap is 3/8ths of an [185] inch, I believe. It is considerably greater than the width of the gap found in the Stewart-Warner device, Defs'. Ex. 2. Increasing the air gap in general increases the amount of current and windings or the number of ampere turns necessary to give you a given flux across the gap. With a large gap it would require more power to give you a given flux than would a small gap. I do not find anywhere in this so-called Lodge instrument, Defs'. Ex. 7, any means for accurately spacing the inner pole from the outer pole and maintaining their concentricity. Any special means for precise spacing are not evident. I do not find in the photograph Defs'. Ex. 9 any screws at the bottom such as are employed in the model Defs'. Ex. 7. As to whether or not the presence or absence of such screws would affect the

(Deposition of Paul E. Sabine.)

alignment of the shell or casing with the inner pole, it would depend on the tightness of the fit with the bottom of the casing. If it were a loose fit then there would be likelihood of movement of the shell or casing with respect to the inner pole. By making the gap as wide as Lodge illustrates, the inner pole might become displaced with respect to the outer pole to some extent without any serious consequences. In Defs'. Ex. 2 I would say that the clearance between the inner surface of the coil and the central pole piece was of the order of between a 16th and a 32nd of an inch. That would allow a certain amount of displacement within that limit without seriously impairing the functioning of the apparatus, but nothing like as great a displacement is allowable in Exhibit 2 as would be in Exhibit 7. In Plff's. Ex. C, which is a drawing of a cross-section of Defs'. Ex. 2, I should say that the part marked "E" performed the function of accurately spacing the inner pole with respect to the outer pole and maintaining their concentricity. [186]

As to the reason why the diaphragm shown in Pridham and Jensen patent 1,448,279 is provided with corrugations or curves, I take it that the purpose of the corrugations is to prevent that blasting that we spoke of awhile ago; that is, to prevent the segmental vibration of the diaphragm. These corrugations in this type of diaphragm that we see in the Pridham and Jensen patent just mentioned, would permit of greater amplitude of movement

(Deposition of Paul E. Sabine.)

than the ordinary flat diaphragm of the same weight of material and thickness. Such diaphragm would appear to give off self-sustaining sound waves in free air without the use of the top portion 2; but less efficiently than it would with the top portion and a horn. One only needs to put on the horn on the Magnavox speaker to see the greater output of sound that results from the action.

XQ. 188 In the same way that it is necessary to use the baffle on a loud speaker having a small-sized cone?

A. In much greater degree.

The statement is made somewhere in the Lodge article (referring to the form of device Defs'. Ex. 7) that it was necessary to hold the ear against the diaphragm. You must remember what Lodge was trying to do was to pick up very faint signals, telegraphic signals and also voice signals. I do not find any mention of voice signals there, but the general tenor of the article and of the patent implies he had voice signals in mind as well. Lodge was dealing with the inductive effects that are transmitted through space, and not wireless telephony in the sense of high frequency oscillations or radio frequency oscillations which we are talking about to-day. What Lodge was dealing with was not the Hertzian waves but these inductive actions transmitted through space from one electrical circuit to another. [187]

(Deposition of Paul E. Sabine.)

Redirect Examination by Mr. Wilkinson:

RDQ. 215 Will you outline the functional differences between a horn and a baffle as used with vibrating diaphragms?

A. The horn is essentially an impedance matching device. We have a small dense diaphragm vibrating in the free atmosphere. Due to the difference in the acoustic resistances of the diaphragm and the medium in which it vibrates, the energy that is radiated as sound waves will be small if there is no intermediate arrangement. The horn and the air chamber or sound box act as this intermediate transformer. At the diaphragm you have large pressure changes with not any great flow on movement of the medium and the function of the horn is to convert this available energy into relatively large movements of a much less dense medium over a larger area and the horn and sound box function in that way and quite similar to the impedance matching transformers that are used in electrical circuits. When you want to transfer energy from one circuit to another that energy is most efficiently transferred when the impedance of the two circuits are as nearly the same as you can get them.

Now the action of a baffle is different. The small diaphragm, let us say, is moving to the right. The pulse of condensation starts from the right side of that diaphragm. At the same time a pulse of rarefaction starts from the left hand side of that dia-

(Deposition of Paul E. Sabine.)

phragm. The rarefaction phase through diffraction is carried around to the right hand side of the diaphragm and will tend to neutralize the compression that is set up by the motion from left to right. Similarly, when the diaphragm is moving to the left it will start a rarefaction phase on the right side of the diaphragm and a compression phase on the left side and through diffraction these two will tend to neutralize each other so that the energy which is radiated from the small diaphragm under these [188] conditions will be small. Now, if we use a baffle, which is nothing more or less than a barrier, around the diaphragm, these two portions of the sound wave that is generated—and we must remember that sound waves are generated from both sides of the diaphragm if the diaphragm is in free space—cannot interfere destructively with each other without passing around the edges of the barrier. In other words, the baffle separates the waves generated from the two faces of the diaphragm so that they do not interfere destructively.

Sound modifiers may be of three sorts, reflectors, horns and resonators. The horn operates, as has been indicated, as an impedance matching device. The baffle acts as a barrier and a reflector. The reflecting function, of course, is present in horns, and we can think of a baffle if we like or we can speak, if you please, of a baffle as a horn of zero length, which is meaningless and simply a confusion of terms.

(Deposition of Paul E. Sabine.)

RDQ. 216 Please state whether or not the differences you have pointed out as between the horn and a baffle exist as between the Pridham and Jensen device as exemplified by Defs'. Ex. 1, when provided with a horn, and defendants' device as exemplified by Defs'. Ex. 2 when provided with a baffle around the larger diameter of the cone.

A. I would say yes.

RDQ. 217. Is there, in your opinion, any feature in the cone with a baffle around it that is functionally equivalent to the sound box in the diaphragm, sound box and horn type of speaker?

A. I can find no equivalent of the sound box in the cone with the baffle.

RDQ. 218. Referring to Pridham and Jensen patent No. 1,579,392, what is therein illustrated as the means for concentrically spacing the inner pole piece F with relation to the outer [189] pole piece C?

A. In line 60 of the Specifications it is stated:

> "We first gauge the cylinder and then place the core F therein and center it by means of a spacing disk 10 of insulating material."

"10" would seem to be the spoolhead of the coil.

RDQ. 219. How does the upper head of the spool, as shown in the enlarged photograph, Defs'. Ex. 9, of the Lodge device, Defs'. Ex. 7, compare as a spacing means having concentrically located the inner and outer pole pieces with the disk 10 in the said Pridham and Jensen patent?

A. Well, I see no difference.

(Deposition of Paul E. Sabine.)

Recross-Examination by Mr. Loftus:

In stating that the spacing disk 10 in Pridham and Jensen patent 1,579,392 is the head of a spool, I made that statement because it looks that way. It is described in the patent as a spacing disk, not as a spool head; but it seems to me to be both. In the Lodge device shown in Fig. 7, Institute of Electrical Engineers, the disk on top of the magnetizing coil is obviously the spool head. In Fig. 7 it fits loosely into the casing or shell, but I am not sure about Fig. 5. In the article in "The Electrician" I would not be prepared to go on record as to whether it is intended to be a tight fit or not in Fig. 5 of the article in "The Electrician." If it were a tight fit it would function as a spacing disk.

The presence of a baffle does increase the acoustical load of the diaphragm, particularly at low frequencies; but the presence of a baffle is a much less important factor in the operation of a cone diaphragm, practically speaking, than is the presence of a horn. It is a matter of degree, but the degree is so large that it becomes almost a matter of kind. [190]

By stipulation, copy of the deposition of Ernest F. Dechow, taken in the case of Magnavox v. Hart & Reno, No. 2534, was offered in evidence, said deposition being as follows: [191]

DEPOSITION OF ERNEST F. DECHOW

a witness on behalf of defendants.

Direct Examination by Mr. Wilkinson:

My name is Ernest F. Dechow. My residence is at 2934 North Sacramento Avenue, Chicago, Illinois. I have been in the electrical business for 26 years, doing enunciator maintenance work.

I know a man named John J. Comer as the man who built the enunciator system for the Automatic Electric Co. I became connected with that company in 1908.

Q. 13. And did the Automatic Electric Company, while you were connected with it, have anything to do with enunciators?

A. Yes, sir.

Q. 14 With what enunciators?

A. That is the automatic enunciator made by Comer.

Q. 15 Did you personally have anything to do with this Comer enunciator?

Mr. LOFTUS: This line of examination is objected to if it has to do with any effort to show anticipation by Comer or Automatic Electric Company on the ground of lack of notice.

Mr. WILKINSON: The testimony of this witness and any exhibits which may be identified by him are offered for the purpose of showing the state of the art and hence need not be pleaded.

Mr. LOFTUS: I do not understand that the privilege of showing the state of the art goes so far as to permit the witness to testify to any prior uses

(Deposition of Ernest F. Dechow.)

or practices where the same have not been set up in the answer, and the objection is repeated.

A. I did. I had charge of the development and manufacturing of it.

Q. 17 I call your attention to Figure 8 of Comer patent No. 1,137,186, dated April 27, 1915, and ask if you understand the [192] device shown in that figure?

Mr. LOFTUS: May it be understood that my objection applies to all of this testimony?

Mr. WILKINSON: It may be so understood.

A. Yes, I understand that thoroughly.

In the Comer enunciators that I have referred to like that shown in Fig. 8 of that Comer patent, it was in 1911 that Automatic Electric Company commenced making the said Comer devices like that shown in Figure 8 of the Comer patent. The device you have produced is one of the old type we called the 11077 reproducer. This particular one is one of the old White Sox Chicago, Comiskey Ball Park speakers.

The extent to which the Comer enunciators were made and installed of the type, for instance, that I have identified is something I couldn't say offhand, but I know we made approximately 50,000 of them at that time, the orders were about 50,000; they went all over the country. Here are some of the places where the Comer enunciators were installed, say as early as 1915: D. B. Fisk & Co. is one place, I just happened to think we overhauled it the

(Deposition of Ernest F. Dechow.)

other day; that was installed in 1912. The White Sox Ball Park was installed in 1913. The Automatic Electric Company was installed in 1911. Those installations I have referred to are all devices such as I hold in my hand; the mechanism was all the same excepting a few changes in the mounting and things of that kind.

Q. 30 Will you just give a brief description of how that enunciator in your hand operates and in doing so, if you desire you can refer to drawing Figure 8 in the Comer patent No. 1,137,186.

A. Well, to begin with, starting from the bottom, of course, I am not very good on explaining these things, we have a perman- [193] ent magnet and an energizing coil. The current passing through the coil energizes the floating armature linked to the mica diaphragm and placed between two gaskets in the sound box, and of course a horn put on the end of this box completes the outfit.

When the current is received in the coil marked *a'* in Figure 8 of the drawing of said Comer patent it energizes the floating armature which is linked to the diaphragm which produces the sound.

(Mr. WILKINSON: A copy of the Comer patent No. 1,137,186, granted April 27, 1915, on an application filed October 24, 1910, is offered in evidence as Defs'. Ex. 37.)

Mr. LOFTUS: Objected to on the ground of lack of notice.

(The exhibit was so marked.)

(Mr. WILKINSON: The enunciator device

(Deposition of Ernest F. Dechow.)

produced by the witness is also offered in evidence as Defs'. Ex. 38.)

Mr. LOFTUS: Same objection.

(The exhibit was so marked.)

Mr. WILKINSON: Direct examination closed.

Mr. LOFTUS: No cross-examination.

Which were all of the proceedings had at the time and place above indicated. (Notarial certificate of Alice M. Rankin attached.) [194]

Defendant offered in evidence copy of patent to J. J. Comer, No. 1,137,186, dated April 27, 1915, being the one referred to in the Dechow deposition; and the same was marked Defs'. Ex. D.D.

By stipulation, copy of the deposition of Clair L. Farrand, taken in the case of Magnavox v. Hart & Reno, No. 2534, was offered in evidence; and in connection therewith a copy of the patent referred to therein, being British Patent 178,862, granted to Clair L. Farrand, was offered. Said patent copy was marked Defs'. Ex. EE. The Farrand deposition follows: [195]

DEPOSITION OF CLAIR L. FARRAND

on behalf of defendants.

(New York, Oct. 6, 1931)

Direct Examination by Mr. Hodgkins:

My name is Clair L. Farrand. My address is Larchmount, New York. I am president of United

(Deposition of Clair L. Farrand.)

Research Corporation, an engineering and research company engaged in electrical and acoustical work. Before that I was president of the Farrand Manufacturing Co., Inc., a company which commenced the manufacturing of radio loudspeakers in 1924, and was in operation in 1929, when it was sold to the Brunswick-Balke-Collender Company. In 1921 I manufactured a so-called Phonetron loudspeaker. This was a moving coil driven cone type loudspeaker and was sold in moderate quantities for radio amateur uses, as this was prior to the days of the broadcasting reception. I am the patentee of British Patent No. 178,862 granted to Clair Loring Farrand.

(Mr. HODGKINS: This photostat copy of a patent is offered in evidence as Defs'. Ex. 39.)

Mr. LOFTUS: Objected to as incompetent, irrelevant and immaterial, and on the ground that it is later than the filing date of the first patent in the suit, and if offered as anticipatory of the second patent in suit, is objected to on the ground of lack of notice.

Q. 8 Will you please state briefly any points of difference or similarity between the structure shown in this patent and that which you stated you marketed in 1921 under the name of Phonetron.

Mr. LOFTUS: That is objected to as calling for secondary evidence; if such devices were made, they should be produced here or their absence explained.

(Deposition of Clair L. Farrand.)

A. The structure shown in this patent is practically [196] identical with the structure marketed by me in 1921. The only difference I see is in the method of fastening the spider support of the cone to the central magnetic pot. The term used to describe this type of speaker is the word "dynamic". It is an abbreviation of the technical term electrodynamic.

A dynamic speaker, as I understand, comprises a conical diaphragm of rather large size, acting directly upon unconfined air and made of light material, supported at its outer edge with a flexible support in an opening in some supporting structure.

Mounted on the center of the conical diaphragm is a voice coil, which floats in a long annular gap, wherein there is a unidirectional magnetic field produced by a field winding which in turn is energized from a separate source. The voice coil is energized by the audio voice frequency currents received from the associated amplifier tubes. The diaphragm is generally supported in a baffle, which may conveniently be an opening in one wall of a radio cabinet.

I have examined Plf's. Ex. C, which is a photostat showing the cross section of the Stewart-Warner loudspeaker complained of in the present suit and understand the construction as shown in the drawing.

I am generally familiar with the horn type loud-

(Deposition of Clair L. Farrand.)

speakers of the sound box and diaphragm type which were on the market for many years. The General Electric Company, Radio Corporation and Westinghouse Companies marketed speakers of that type for radio broadcast reception but they are not being marketed now. The reason they are not being marketed is that it is possible to obtain a superior musical reproduction with the dynamic type loudspeaker.

I am familiar with the differences in construction and [197] principle of operation of the dynamic cone type loudspeaker and the sound box diaphragm and the horn type of loudspeaker. The differences are these: The sound box and horn type loudspeaker comprises an actuating motor element generally fastened to a small flat diaphragm which forms one wall of an enclosed chamber called a sound box. The opposite wall of this chamber has a small opening, to which is fastened the throat of a horn. The walls of the horn taper outwardly to a bell-like opening, the size of which is dependent upon the lowest tone it is desired to reproduce. The action of this device is that the diaphragm moving small distances compresses the air in the chamber of the sound box to a very high degree of compression. This high compression wave is applied to the throat of the horn and expands outward toward the bell-like opening, and as it expands outwardly its pressure is reduced, due to the increasing area, until when it arrives at the opening of the horn it is a relatively low pressure air wave.

(Deposition of Clair L. Farrand.)

On the other hand, the dynamic type loudspeaker does not employ the horn. The conical diaphragm operates directly on the air at approximately the same pressure as is arrived at at the bell opening of the horn in the case of the sound box-horn combination. The magnetic motor element fastened to the center of the cone displaces the conical diaphragm, compresses the air adjacent to it in a relatively large volume, requiring considerable displacement. The low pressure air wave expands outward directly, being unconfined to the listener. A baffle is usually associated with this type of diaphragm to prevent the intermingling of the air wave produced on the concave side of the cone with the air wave produced on the convex side of the cone. This intermingling and cancellation thereby produced is most pronounced at the lower or bass tones, which are waves of relatively long length. The [198] diaphragm is sufficient to separate the shorter waves of the higher frequencies.

The amplitude of the movement of the diaphragm of the sound box-horn combination is very much smaller than the motion of the cone diaphragm of the dynamic speaker. The former, for an equal intensity of sound, may, for instance, move a maximum distance of five-thousandths of an inch to ten-thousandths of an inch, whereas the conical diaphragm of the dynamic speaker would for the same intensity of sound move ten or twenty times that, that is, approximately one-tenth inch.

(Deposition of Clair L. Farrand.)

The speaker of Plf's. Ex. C does not contain a sound box. It does have a conical diaphragm, and from its design is for use directly upon unconfined air without the use of a horn. Sound boxes generally are used with horns. This construction of Plf's. Ex. C is then a dynamic cone type speaker such as I have described. The first dynamic cone type speaker on the market prior to June, 1927, was the Phonetron, which I have described, and is illustrated in British patent 178,862, which was marketed in 1921. A loudspeaker of this type was model 104, manufactured by the General Electric Company and Westinghouse Electric and Manufacturing Company for the Radio Corporation of America, and sold by them as the Radiola models, and also sold by the Victor Talking Machine Company and the Brunswick-Balke-Collender Company. This RCA 104 was marketed commencing in 1925. This is a drawing of the Radiola RCA 104 speaker.

(Mr. HODGKINS: This photostat is offered in evidence as Defs'. Ex. 40.)

Mr. LOFTUS: Objected to as secondary and not the best evidence. If any such devices were constructed and placed upon the market, it would seem that physical models thereof should [199] now be available. Moreover, there was no foundation laid for the introduction of a drawing of this character.

There were other cone type loudspeakers for radio use sold prior to June, 1927, of the so-called magnetic drive type. They were manufactured by the

(Deposition of Clair L. Farrand.)

Western Electric Company and Farrand Manufacturing Company, and several other manufacturers, and consisted of both double cones and single cone driven by magnetic type driving motors. The cone type speaker has displaced the sound box and horn type, due to the fact that you can obtain a more faithful musical reproduction with the cone itself, and also with the cone and an associated moving coil drive than can be obtained with the sound box and horn, when the latter is built to a convenient commercial size. This difference in reproduction is particularly noticeable in the quality of the bass reproduction, being more faithful, and also that the musical range of reproduction is more extensive than when the sound is produced by the sound box-horn combination.

In 1922 broadcasting started to such an extent that it was available to the public in general for home reception on broadcast receivers. Loudspeakers were in use prior to 1922. I recall one installation prior to 1915 in the waiting room of the Grand Central Station in New York City of sound box and horn combinations which were installed there for train annunciation. I am quite sure they were not Magnavox loudspeakers.

Q. 35 I call your attention to the fact that the Pridham et al. patent 1,448,279, which is one of the patents in suit, contains in lines 102 on page 1 and following over to the top of page 2 a statement as to the depth of the air gap in which it states:

(Deposition of Clair L. Farrand.)

> "Thus the depth of the air gap for maximum efficiency cannot be more than one-quarter of the diameter of the central pole, as the area of the cylinder equals the cross section of the cylinder when the latitude of the cylinder is equal to one-fourth its diameter;" [200]

Will you state whether or not you agree that this is a correct statement as to the requirement in a dynamic phone type speaker?

A. I do not think it is correct to say this is a specific limitation of design of a dynamic speaker. It merely is a statement which, as I see it, gives the minimum weight of iron if one had only to consider the magnitude of flux density at the gap and no other considerations were involved. The design of a dynamic speaker for maximum efficiency is quite a complex problem and depends on many other factors in addition to flux density for maximum efficiency.

In the dynamic type cone speakers which my company manufactured we did not use anything in the nature of a spacing ring mounted upon the pole piece.

Q. 37 Did you have any difficulty with maintaining proper spacing in shipping and handling your speakers.

Mr. LOFTUS: That is objected to as an attempt to show lack of utility in the subject matter of the patent in suit, which defense is not open to these defendants in view of the fact that they are using such spacing means.

(Deposition of Clair L. Farrand.)

A. We did not. To my knowledge the RCA 104 speakers produced and distributed in 1925 were satisfactory in operation. They were very widely used.

The dynamic cone type speakers which were made by the Farrand Company from 1924 to 1929 we thought were satisfactory. During those years 1924 or 1925 we made approximately between 50,000 and 100,000 speakers. [201]

Cross Examination by Mr. Loftus:

In this British patent of mine, Defs'. Ex. 39, the actuating mechanism in Fig. 1 is the so-called magnetic type drive. The difference between the magnetic type drive and the dynamic drive, is that in the former the moving element is a piece of iron, indicated by the letter *j,* which is actuated through its association with the poles *k-k,* around which are wound coils *m-m.* The poles are magnetized by a permanent magnet.

The dynamic type drive utilizes as an actuating element—referring to Fig. 2 of the same patent—a moving coil *M,* large, placed in an annular field between the center pole piece *g* and the plate *s.* A unidirectional field is produced across this annular gap by energizing the winding *W* large. The advantage of the so-called dynamic drive over the so-called magnetic drive is that the dynamic drive is capable of handling larger powers, and also of moving the cone to larger displacements, without distortion.

XQ. 5 What about the factor of the restoring

(Deposition of Clair L. Farrand.)

force of the moving member of the actuating device?

A. The restoring force of the actuating device is a little different in the two cases. I might add that the form of magnetic drive commonly used, referred to in my previous testimony, employed a different magnetic structure than that shown in Fig. 1. It was of the so-called balanced armature type wherein the moving element, that is, the iron armature, was associated between two pairs of poles in such a way that it was normally balanced as to the magnetic pull and was maintained in this balanced condition by means of a spring of just sufficient power to so retain it. This is a slight restoring force to the structure as a whole, whereas the dynamic type drive, as shown in Fig. 2, did not have an additional restoring [202] force associated with the coil. However, the dynamic speaker, as manufactured, had a slight restoring force associated with the moving coil in the form of a coil support. This is shown on the sketch of the Radiola 104.

XQ. 6. What about the matter of the indirect connection between the actuating member *j* and the diaphragm in the case of the magnetic drive, and the direct connection between the moving coil and the diaphragm which is ordinarily employed in a dynamic type drive?

A. The connection usually employed with the magnetic drive involved a lever to increase the amplitude of motion of the armature when applied to the apex of its cone; the dynamic drive did not use this lever to increase the motion.

(Deposition of Clair L. Farrand.)

XQ. 7. Did not that leverage connection manifest itself in some sort of objectionable tones or sounds in the case of the magnetic drive?

A. Yes, it was one of the features which limited the power which the magnetic drive would handle.

XQ. 8. I was referring more to the matter of harmonics.

A. I believe it was constructed in some designs so that it introduced objectionable resonances, but this feature, however, was not inherent, and in some designs was placed at such points in the musical spectrum as to be unobjectionable.

XQ. 9. And yet that type of drive, known as the magnetic, has practically disappeared from the market, has it not, in this country, at least?

A. Yes, the dynamic type speaker has practically replaced it.

My understanding of the word "dynamic" as applied to loud speakers is that there should be a large conical diaphragm operating in free air. The Pridham and Jensen patent 1,448,279 presupposes a receiver of the electrodynamic type. I would not apply the term "dynamic" or "electrodynamic" to a speaker of the [203] moving coil type wherein a horn was employed. I do not think that the word "dynamic" or "electrodynamic" describes any particular element of the speaker. It is a term which in physics means power or force, and has been used and is now used to describe one thing, that is, a conical diaphragm with moving coil drive. I first heard of the Magnavox loud speaker about 1917, and

(Deposition of Clair L. Farrand.)

had one in my possession about 1919. At or about that time I heard of the word "electrodynamic" applied to that type of speaker. "Electrodynamic" and "dynamic" are words used in physics when describing loud speakers. The word "dynamic" was first used to describe the moving coil driven cone around 1925 to 1927, and later manufacturers changed their designations to "electrodynamic", I believe, as they were afraid that Magnavox had some trade mark rights on the term. The demand for loud speakers prior to the advent of broadcasting was very small. There was a demand in connection with public-address work, but I would not call it considerable in comparison with our present-day ideas of production. I would call it very small.

XQ. 66. When you say that the cone diaphragm of large size not using the horn is superior to a smaller diaphragm using the horn, have you considered the matter of the so-called exponential horn?

A. Yes, the exponential horn to reproduce the lower tones must have a relatively large length, and such a large opening that they would not be of convenient size to use in the normal home for purposes of radio reception.

XQ. 67. But where space or appearance is not a factor, such a horn does produce tones and ranges and volume superior to the large cone, does it not?

A. No, not nearly as well.

XQ. 68. How do you account for the extensive use of the horn in connection with loudspeakers

(Deposition of Clair L. Farrand.)

employed for talking motion [204] picture purposes?

A. It is rather difficult to account for its continued use by Western Electric Company, after the use by the R.C.A. Photophone Corporation of the large conical diaphragm for talking picture reproduction, as the latter, in my opinion, is much improved reproduction.

XQ. 69. At the present time, have you any idea as to the percentage of loudspeakers using horns and those using the large cone in the talking picture industry?

A. I believe that the use of large horns exceeds, in quantity, the use of moving coil-driven cones, but feel that it is due to the fact that the horn was the device first chosen, rather than due to its excellence or superiority of operation.

XQ. 70. In your work here with Warner Brothers Picture Company, which type do you use, the horn or the large cone?

A. We are confining ourselves to coil-driven cones, as we have determined that they produce a superior quality of reproduction.

XQ. 71. But the Warner Brothers have used and still use the horn, do they not?

A. Warner Brothers are a licensee of Electrical Research Products, and the large horn is the only model available to them through that license.

XQ. 72. You say that in the so-called sound box or horn type, the sound waves are compressed; now,

(Deposition of Clair L. Farrand.)

is this not also true of the large cone mounted in a baffle?

A. What I was referring to when I spoke of compression of the air was that in the sound box-horn combination the small displacement of the diaphragm created a very large air pressure which required transformation through the horn to a low pressure and emitted as a sound wave. The moving coil-driven cone, however, initiates the sound wave by means of the air at low compression, and does not require the transformation by means of a horn. [205]

XQ. 73. This compression, nevertheless, takes place where a baffle surrounds the cone, does it not?

A. It takes place whether or not the baffle does surround the cone, and is essential for the reproduction of sound. The difference between the sound-box-horn combination and the moving coil-driven cone is, as far as pressure goes, the magnitude of the original pressure in the vicinity of the diaphragm.

XQ. 74. Have you ever observed that where a relatively large cone is employed without a baffle, its amplitude of movement is generally greater than when a baffle surrounds the cone?

A. The amplitude of movement of a cone with or without the baffle at the higher frequencies is substantially the same.

XQ. 75. Well, tell us about the lower frequencies.

A. At the lower frequencies the amplitude of

(Deposition of Clair L. Farrand.)

motion in general increases both with and without a baffle; that is, in comparison with the amplitude of movement in the higher frequencies. This is essential to radiate the lower frequencies in proportion with the higher frequencies; and when the baffle in omitted, as I described before in my testimony, the sound wave, the compression wave from the concave side of the cone circulates and intermingles with the compression wave in the convex side of the cone, and a cancellation results, which practically means that the air is circulated at the extremely lower frequencies from one side of the diaphragm to the other. This results in a larger motion, as you do not get a loading effect on the diaphragm, at frequencies, we will say, of 100 cycles and below that, than you get when you place the diaphragm in a baffle and separate these two waves and prevent their cancellation.

XQ. 76. So that the presence of a baffle does produce this loading effect on the cone or diaphragm?

A. Yes, at extreme low frequencies. [206]

XQ. 77. Then it is not strictly correct to say that the cone is operating in free air, is it?

A. I think it is. Both sides of the diaphragm may be, and generally one side is exposed to as free air as is possible to obtain.

XQ. 78. You recognize the fact that there are many authorities who disagree with you on that point, do you not?

A. I do not think that there is a general disagreement on that.

(Deposition of Clair L. Farrand.)

XQ. 79. These are the same theories that you expounded in that same case of Lektophone against Rola as to the operation of the cone?

A. I don't recall that I expounded them in that case, but I have been associated with this art for many years and the theories I have given seem to be generally accepted and sound.

XQ. 80. Referring to this drawing, Def's. Ex. 40, you have never checked that drawing with an actual Radiola of R.C.A. 104, have you?

A. My recollection is that I checked this drawing at the time of the Magnavox against Thompson suit on the Majestic loudspeaker. It is generally of the size, proportion and design of the Radiola 104, as I am quite familiar with the structure of that device.

XQ. 81. The statement appearing in Pridham and Jensen patent 1,448,279, to which your attention was called on direct examination, namely, "Thus the depth of the air gap for maximum efficiency can not be more than one-quarter of the diameter of the center pole," et cetera, is substantially correct in so far as any statement may be made to cover conditions in general, is it not?

A. I would not say that it covers conditions in general; it merely means that when the section of the air gap equals the cross-section of the central pole that the iron in both places is worked at the same density. I do not consider this an essential relation for maximum efficiency of a loudspeaker,

(Deposition of Clair L. Farrand.)

as in some cases you really require more or less iron in either place.

XQ. 82. Well, there is nothing inaccurate in that statement, is there?

A. No, it shows a general understanding of the design of a magnetic system. [207]

XQ. 83 What was the first loud speaker of the moving coil type that you actually saw in existence or upon the market?

A. The first loudspeaker of the moving coil type I saw on the market was a Magnavox sound-box-horn combination. [208]

Redirect Examination by Mr. Hodgkins:

The Phonetron produced by me and sold in 1921 was the first loudspeaker of the voice coil type and of the cone type which I first saw in actual operation. The first cone-type voice coil speaker which I saw in commercial production after broadcasting became general was the Radiola 104.

Recross Examination by Mr. Loftus:

RXQ. 84 In your direct examination you made frequent reference to a small flat diaphragm. Have you observed that the diaphragm illustrated in Pridham and Jensen Patent 1,448,279 is not a flat diaphragm?

A. It is a flat diaphragm, in which there are stamped some circular corrugations. I would say it is of the flat diaphragm type, and departs from it only in that regard.

(Deposition of Clair L. Farrand.)

RXQ. 85 What would be the purpose or effect of those corrugations or curves in the diaphragm illustrated in said patent?

A. Circular corrugations have been generally used in flat diaphragms in the telephone art to prevent the diaphragm breaking up into what are known as Chladni patterns.

RXQ. 86 Doesn't it also permit a greater amplitude of motion in the diaphragm?

A. It permits a slightly greater amplitude of motion, but diaphragms of this character as used [209] in the early Magnavox speakers were inherently very stiff in comparison with the present-day dynamic structures.

RXQ. 87 Had you noticed that the Pridham and Jensen patent referred to describes the diaphragm as a flexible diaphragm?

A. I imagine it would be so described, as all flat diaphragms are flexible and depend upon this flexibility to produce the high compression sound wave in the chamber.

RXQ. 88 Do you know of any reason why a diaphragm made substantially like that shown in the Pridham and Jensen patent 1,448,279 would not operate to give off what you have in the past called self-sustaining sound waves in the free air if the horn and the top of the so-called sound box were removed?

A. If the top of the sound box were removed in the disclosure of the Pridham-Jensen patent and the

(Deposition of Clair L. Farrand.)

diaphragm exposed to free air, it would make a noise, and sound waves, but would not be a device which in any way should be commercial or useful, as the requirements of loudspeakers are interpreted.

RXQ. 89 What is the smallest diameter cone diaphragm that you have observed in commercial use in connection with loudspeakers?

A. They vary somewhat, but approximately six inches in diameter is the smallest that is in general commercial use.

RXQ. 90 Now, in connection with the so-called midget sets, you have seen some that are as small as three and a half or four inches in diameter, have you not?

A. I do not recall seeing any quite as small as that; there have been some small ones made, but they lose markedly in their quality of reproduction.

RXQ. 91 There was one period in your career as the champion of the Hopkins patents, when you thought that a cone less than nine inches in diameter would not operate satisfactorily, was there not?

A. It has to do with intrepation as such. This is a [210] matter of degree, and generally if the cone is reduced in size, a loss in quality of reproduction is suffered. I still believe and know from actual tests that the larger the cone up to approximately twelve inches or so, the better the reproduction, and as the cone is reduced in size to three or four inches in diameter, the reproduction becomes relatively very poor.

(Deposition of Clair L. Farrand.)

Redirect Examination by Mr. Hodgkins:

RDQ. 44 Referring again to the Pridham et al. patent 1,448,279, if, as was asked on recross examination, the top of the sound box and horn were removed, would the diaphragm then be in free air as regards both sides of the diaphragm?

A. No, there still would be a chamber enclosed on the side of the diaphragm toward the voice coil.

RDQ. 45 Do the circumferential corrugations in the diaphragm of this patent cause the diaphragm to become a cone?

A. No.

Recross Examination by Mr. Loftus:

RXQ. 92 In one of your later answers you said that there would still be a closed chamber on the side of the diaphragm towards the moving coil, you then referred to patent 1,448,279, but that is not true of patent 1,579,392, which is also here in suit, is it?

A. That would not be the case if the drawing means to convey that the spacers surrounding these screws 20 are cylindrical and separate from each other; then the diaphragm would have a small annular enclosure on the side towards the voice coil and an opening of several inches in diameter.

(Notarial certificate of Arthur C. Smith attached). [211]

A copy of the drawing of the R. C. A. Speaker Number 104, referred to in the Farrand deposition, was offered in evidence, and the same was

(Deposition of Clair L. Farrand.)

marked Defs'. Ex. FF. Defendant offered in evidence certified copy fo the Patent Office record in the matter of Interference between Valentine Ford Greaves, assignor to The Magnavox Company vs. Edward W. Kellogg. The same was objected to on the ground that it was immaterial, as it related to matters occurring long after the dates of the patents in suit, and as needlessly encumbering the record. (Objection overruled and exception noted.) The document was marked Defs'. Ex. GG. Defendants reoffered in evidence the device of the Kellogg publication previously marked Defs'. Ex. CC. The same was objected to as immaterial, and as relating to matters occurring long after the dates of the patents in suit, and as needlessly encumbering the record. (Objection overruled and exception noted.) The document was received as a formal exhibit and marked Defs'. Ex. CC. Defendants offered in evidence as a single exhibit Patents 1,051,113 to Pridham and Jensen, January 21, 1913; 1,088,283, February 24, 1914; and 1,105,924, August 4, 1914; and the same were marked Defs'. Ex. HH. Defendants offered in evidence the so-called "Blue Book" entitled "Pictorial Digest of the Art," and the same was objected to as mere argument, and objection sustained. [212]

EDWIN S. PRIDHAM,

Recalled for Plaintiff in Rebuttal.

Direct Examination by Mr. Loftus:

Q. Will you briefly explain the developments leading up to the invention of the two patents in suit?

Mr. MILLER: I object to that, your Honor, as not proper rebuttal. That is a part of his prima facie case.

The COURT: The objection is overruled; exception.

A. I have been connected with the art of communication, especially electrical communication, for 35 years, being employed by the Western Electric, the Chicago Telephone Company, and other telephone companies. I am a graduate of Stanford University, Department of Physics, 1909. I was employed by the Poulsen Wireless Telegraph Company in 1910, where I met Mr. Jensen, who is co-inventor with me in these patents. We were sent to Europe to study the wireless companies and the methods of operation in 1910. In 1911 there was formed the Commercial Wireless & Development Company by some San Francisco men, among whom were Mr. Richard O'Connor, Matt I. Sullivan, and others. We established a laboratory in Napa in 1911 for the purpose of undertaking a study of the reproduction of radio impulses and general problems in communication. While there we made a very interesting discovery of the effect of tele-

(Testimony of Edwin S. Pridham.)

phonic currents on a conductor when disposed in a magnetic field. This was a very crude device. It consisted of a single wire stretched in a magnetic field, connected to a very large diaphragm, although it produced the voice rather weak, we continued our experiments along this line, gradually improving this device in 1913 and 1914 on telephone lines. In the Fall of 1914 we took this instrument to New York City and talked from New York to Denver without the assistance of amplifiers, Pupin coils, or other apparatus to strengthen the currents, showing very conclusively that our [213] apparatus was very successful in telephone reproduction. The problems that we had to attack were various, and were very difficult of solution. It took quite a bit of time; we had several mechanics; it took quite a bit of money. We ran very short of money, and times were exceedingly hard for us, but we had an idea in our minds that we would run onto a very successful telephone reproducer; and although we were very greatly in debt and really had a very difficult time to get along, we kept at our work. One evening I called Mr. O'Connor up from the laboratory and told him we were 4 or 5 months behind in our bills, the mechanics had not been paid. He said, "Well, young fellow, times are tough; hardly anyone has got any money now; you have not produced a successful instrument." I told him then that we had just produced a very successful loud-speaking telephone.

(Testimony of Edwin S. Pridham.)

It rather interested him immediately to think that we had produced something that would be commercially successful. He said that he would send his son Charlie up to hear this instrument. When Charlie came up on the next Sunday we had this instrument arranged on the roof of the house, on the chimney. A very large horn was connected to the instrument. The voice was propelled through the air for a distance of 4 miles. At night in the Napa Valley records played on a phonograph could be heard throughout the Napa Valley, a distance of 9 or 10 miles. It created a very great sensation. Lieutenant-Commander Sweet, who had charge of radio work at Mare Island, came up to the laboratory and was much impressed with this loudspeaking telephone, because it was exceedingly loud. We were invited by the Exposition offiicals to give demonstrations at the Exposition from the Tower of Jewels. The reproduction from these instruments could be heard out on the battleships in the Bay, and in fact, the sailors even danced on the decks to the music. We gave a very important [214] demonstration at the dedication of the City Hall in 1915. Mayor Rolph and other important men spoke to a crowd of over 50,000 people gathered there. Alice Gentle sang national airs over the instrument. There was a great deal of interest, both local and national. The Navy at that time was interested in docking vessels by means of our instruments. They ordered some instruments, and

(Testimony of Edwin S. Pridham.)

vessels were docked at the Bremerton Navy Yard very successfully. During all of these demonstrations we had one very great difficulty, the vibration of the coil in the magnetic field was very intense. That coil was wound with a fine wire in order to expose a great length of wire to the effect of the magnetic field. When these fine wires were brought directly out to the operating circuit we had trouble with the wires crystallizing and breaking off That was a very great and serious difficulty for us. We finally solved this difficulty by the ingenious method of connecting the operating circuit wires to the coil, where the coil wires were attached to the diaphragm. This completely obviated any danger of the breaking of the wires. This method and means has been used ever since in practically all dynamic speakers to date.

Q. In what form, referring to this diaphragm forming a part of Defs'. Ex. A?

A. This connection on this diaphragm simply was one form of connection which we used to the coil of the magnetic field. The proposition was simply this, to attach wires of the operating circuit to the fine wires of the coil where the fine wires were attached to the diaphragm. Thus the fine wires would flex with the diaphragm. It was not at all necessary, neither did we always connect the operating circuit wires to the diaphragm with glue; many times we used a tinsel wire which was brought

(Testimony of Edwin S. Pridham.)

right off from the fastening means for the coil to the diaphragm. [215]

Q. Is that illustrated anywhere in any of your patents?

A. Yes. I would like to call your attention, in Patent No. 1,266,988, in Fig. 10 of that patent, the wires which are shown there as No 27 are not connected to the diaphragm throughout its length; it is connected at the center of the diaphragm where the coil wires of the diaphragm are connected The claim simply says: "A vibrating conducting coil for the telephonic currents disposed in said field, and rigidly secured to the diaphragm and connections between said coil and the operating circuit, comprising thin metallic strips secured to the diaphragm." Now, in another patent in which we use exactly the same instrument, that patent being No. 1,329,928——

Mr. MILLER: I object to that, your Honor; that patent is not sued on.

Mr. LOFTUS: It is just to illustrate the testimony.

The COURT: You may proceed. It is for the purpose of illustrating the testimony, Mr. Miller.

A. In that case, in Fig. 10 we show the wire of the operating circuit as not connected throughout its length to the diaphragm, but simply leading from the center of the diaphragm where the coil is connected from the diaphragm to the operating circuit. We did not intend at any time to limit ourselves——

(Testimony of Edwin S. Pridham.)

Mr. MILLER: I object, your Honor, as to what he intended to do. That is to be gathered from the patent.

The COURT: Objection overruled.

Mr MILLER: Exception

A. We did not intend at any time to limit ourselves solely to gluing this strip to the diaphragm throughout its length to the periphery or a point near the periphery. We did use that many times, in thousands of our instruments, but we also used the other method of connecting the operating wires to the conducting coil in many hundreds of thousands of instruments that we made. At all times this method of conducting the movable coil which was disposed [216] in the magnetic field to the operating circuit simply consisted of connecting the operating circuit wires to the fine wire of the movable coil at a point on the diaphragm so that the anchoring point, you might say, of the connection would flex with the diaphragm, and consequently the wires would not crystallize and break. In this manner we solved the difficulties. I might say it has been exceedingly successful.

Mr. LOFTUS: Q. After this first device that you speak of, that is, the attaching of the lead-out wires to the diaphragm, what further occurred in connection with the development of the loud speaker?

A. After giving these matters considerable thought and solving this problem of the breaking

(Testimony of Edwin S. Pridham.)

of the wires, we thought we had at last arrived at a very successful loudspeaker. This was in 1915 and 1916 that this particular action happened. However, we were very far from a successful instrument in the matter of shipping the instruments abroad, and having them handled by the public. We worked, you might say, day and night on this problem. The first flush of victory, you might say, was over. The people who were backing the company began to be a little tired of not having any commercial success. It spurred us on more and more to finally arrive at a successful instrument. I remember well at that time both Mr. Jensen and I were very hard-pressed. We simply had to have something to get a real commercial instrument that could be sold in quantities. It was a very difficult matter to find a solution for this. We had very good friends at Mare Island. They suggested using these instruments in aeroplanes. The country at that time was getting ready for the war. Lieutenant-Commander Sweet especially thought that the "Magnavox", which we had called these instruments, could be used in aeroplanes for communication. We installed several in planes, at the risk of our lives, you [217] might say. Confusion was simply confounded when a man spoke into a transmitter. The Magnavox would simply roar out indistinguishable sounds, due to the fact that the Magnavox amplified the sounds of the propeller and the engines to an enormous degree, and

(Testimony of Edwin S. Pridham.)

it was not at all satisfactory At this time practically all work on telephone loudspeakers ceased and we were wholly engaged in developing what is known as the "anti-noise transmitter" for the Government, which was very successful in aeroplane communication. I mention this simply to let you know the reason for a hiatus in our experiments in the loudspeaker. After the war this anti-noise transmitter was used on submarines and destroyers. In 1919 we again took up very active work in the development of this loudspeaker. At this time we developed the invention which is outlined in the second patent, which is No. 1,448.279. This patent was applied for April 28, 1920. For practically two years before that time (at least a year and a half) we were busy developing this new type of loudspeaker. We succeeded in developing a very efficient loudspeaker which has stood the test of time We sold over 400,000 of this particular type, as shown in the patent. It was known throughout the world as the Magnavox dynamic loudspeaker. It was shipped practically to the ends of the earth. It would not get out of order; it was exceedingly robust. At one time in giving a demonstration at the Bureau of Standards an instrument dropped out of the second-story window while they were receiving radio signals, I believe, from Honolulu, or from some distand station. We went out and picked up the instrument and hooked onto the line again and it still operated. That

(Testimony of Edwin S. Pridham.)

shows the very robust construction of the instrument. That instrument, which is the subject of this patent, completely solved our difficulties in presenting to the world a successful dynamic loudspeaker. It has been used in [218] a very great number of different ways Mr. Jensen and myself developed the first public address systems that were ever used. Whenever very large crowds of people would gather together and prominent men would want to speak to them, the Magnavox Company would get a hurry-up call to supply the Magnavox. In San Diego President Wilson talked to a crowd that filled the whole stadium, estimated at 50,000 people. The Prince of Wales also talked to a very large crowd of people, using a Magnavox. Practically all of the Presidents of the United States have talked to very large crowds of people, using Magnavox instruments. At that time there was no loudspeaker on the market which would do this. When radio broadcasting got into full swing the Western Electric took up the art of public address work, and by arrangement, practically, with them we permitted them to do all the public address work; we made an agreement whereby we would confine our efforts entirely to the use of loudspeakers for radio broadcasting purposes. There was no threat or anything like that; this arrangement was simply a friendly agreement. Since then, of course, Western Electric has done an enormous amount of work, on successful public address work.

(Testimony of Edwin S. Pridham.)

Q. You referred to the various phases of use of the Magnavox; have you any photographs or articles illustrating those different uses?

A. The Magnavox Company being a commercial organization, that is, organized for profit, to sell goods, we always kept a very large collection of all public notices for use for advertising purposes. This little booklet here, of course, had nothing to do with the Magnavox Company's advertising. This was perfectly free of charge. A public notice like this one from New Zealand, and Australia, and from "Science and Invention," and from the popular magazine articles describing Magnavox, also "The Electrical Experimenter," showing a picture of a particular [219] demonstration, of course we kept all those. When I said we kept a book for advertising purposes I did not refer to these articles appearing in magazines. The "Scientific American" had a very long article on Magnavox, and no money was paid them for that; that was simply because of public interest in these devices that that was published. I would like to identify this clipping, here, as illustrating that.

Q. These are photostats of articles which appeared in technical magazines relative to the Magnavox, and which were not in the nature of paid advertisements; is that correct.

A. Absolutely.

Mr. LOFTUS: I offer in evidence this pamphlet that has just been identified by the witness.

(Testimony of Edwin S. Pridham.)

Mr. MILLER: I object to it. My objection, stated fully, is that these newspaper articles are not competent evidence against us, nor are they relevant in the case, because they are hearsay evidence, and, therefore, should not be used.

The COURT: Objection overruled; exception.

Mr. MILLER: Yes, I take an exception, because I want to test that ruling, your Honor.

(The document was marked "Plf's. Ex. 8.")

A. (Continuing) I would also like to present in the same regard this folder of photographs taken at various meetings where the Magnavox was used to address large crowds of people.

Mr. LOFTUS: I offer the group of photographs referred to by the witness.

Mr. MILLER: I object to them as immaterial, irrelevant and incompetent, purely hearsay, and not binding on us; no sufficient foundation has been laid for the introduction of the photographs, that is, proving their authenticity.

The COURT: Q. They are photographs. Where did you get them?

A. Those photographs were made at different meetings [220] where Magnavoxes were used. For instance, President Harding addressing the convention at Minneapolis; President Taft using the Magnavox at Chicago. They are simply illustrating the fact that Magnavox was at that time considered to be a successful loudspeaker.

(Testimony of Edwin S. Pridham.)

Mr. MILLER: Q. Who took these photographs?

A. Different press associations.

The COURT: Q. And you gathered from the press associations?

A. Yes, we gathered them from the press associations.

Mr. MILLER: Q. Who put on this one, "President Harding using a Magnavox, 1920"?

A. I imagine the stenographer simply indicated that there to show what it was.

Mr. MILLER: Here is another one: "Ex-President Taft using a Magnavox in Chicago, 1919." Who put that on there?

A. I imagine our stenographer put it on there.

Q. Your San Francisco stenographer?

A. Mr. Loftus' stenographer.

Q. Was that stenographer over there when President Taft was using the Magnavox?

A. No, I don't imagine so.

Q. How do you know that President Taft used this Magnavox at that time?

A. I was there personally, myself, and gave the demonstration.

The COURT: Q. Were you there each time these pictures show?

A. Yes, I was there each time these pictures show; I was there personally; I operated the apparatus.

Mr. MILLER: Q. You mean the Magnavox apparatus?

A. Yes.

(Testimony of Edwin S. Pridham.)

Q. But you didn't take the photographs?

A. No, but I was there when the photograph was taken, and I saw it taken; and I told the stenographer what it was.

Mr. MILLER: Q. "Admiral Sims, Washington, 1919." Do you know as regards that?

A. Yes, I was present at that demonstration, and I instructed the stenographer to put that designation on that photograph. [221]

Q. The next is "City Hall, in San Francisco, 1916"; what have you to say about that?

A. I was present at that demonstration; and I instructed the stenographer to put that designation on it.

Q. You did not take the photographs?

A. No, I did not.

Q. You don't know whether the photographs are correct, do you?

A. Yes, I do.

Q. How do you know it?

A. I was present right at the time the photographer took the photograph.

Q. How do you know that the photographer was correct in taking the photograph? You simply stood by and saw him take a photograph. You come here now and present a photograph here and you say that it is correct, and you say that is the photograph which was taken at that time, do you?

A. Yes. For instance, I might have posed the

(Testimony of Edwin S. Pridham.)

group, myself, and told the photographer to take the picture of the group.

Q. Did you pose the group?

A. Yes, generally I did.

Q. Here are some thousands of people; did you pose that group,

A. I imagine I did; every one of them.

Q. You went out and posed the whole 50,000 that are there.

A. Yes, if you want to ask that question. I mean I was present and the photographer took the picture, and I could tell from the result of the picture that it was a correct picture.

(The photographs identified by the witness were again offered in evidence and objected to as immaterial, irrelevant, incompetent, and no sufficient foundation laid, and as not binding on defendants. Objection overruled and exception noted. The group of photographs, consisting of four in all, were here marked "Plff's. Ex. 9.")

In saying that I posed the groups in the photograph Pff's. Ex. 9, I simply meant that the camera was directed toward the crowd in order to get a reasonably satisfactory picture. [222] The photographs, Plff's. Ex. 9, were of the earlier form of instrument as shown in the first patent in suit. That is with the flat type of voice coil. I have other photographs of the form of device illustrated in the second patent in suit, showing the various uses to which the device was put. The originals of these

(Testimony of Edwin S. Pridham.)
were offered in the trial of Magnavox v. Hart & Reno, and I have photostat copies thereof. The photographs of which the present photostats are copies were practically all taken under my supervision. No. 1 shows Governor Cox at the Fair Grounds in Dayton, Ohio, in 1920. I was present. No. 2 shows some gentleman using the Magnavox at the Minnesota State Fair. I was not present on that occasion. No. 3 shows the Magnavox instruments being used to announce to a very large concourse of people at the Gravesend Race Track, New York City. I was present at the race track and actually installed the instruments; but I was not present at the time Mayor Hylan made the talk. No. 4 shows the Magnavox loud speaker for directing traffic at the football games at the University of California in 1920. I installed that apparatus myself and directed the traffic to the football game from the street cars. No. 5 shows the type of "Telemegafone" (which we called the type of instrument) which was used at the University of California to direct football traffic. No. 6 shows the instrument being used in directing motion pictures. I was present at the moving picture studio lot and gave a demonstration to William DeMille. No. 7 is simply a display in which the Magnavox is shown. I was not present when this photograph was taken. Picture No. 8 was taken in April 1919. I was present at that demonstration and it shows a part of the large crowd at the Treasury Building in Washing-

(Testimony of Edwin S. Pridham.)

ton. No. 9 is a telegram from the Chief Signal Officer, U. S. Army, Major General Squier. I saw these telegrams when they [223] were received. There is absolutely no question that they were received, because we made the apparatus and sent it to the Army. The next photograph, page 10, shows the use of the Magnavox loudspeaker for attracting crowds to shop-windows; the reverse side showing the use of the Magnavox speaker for dance-halls. I personally installed the Magnavox loudspeaker shown in this particular drawing. "That Man Pitts" had a little stationery store, as your Honor might remember, and we installed the Magnavox; the demonstrator inside the window would talk into a transmitter, such as they do in thousands of places to-day, explaining something inside the window to the crowd outside. We conceived the idea that it would be a very fine thing to have a loudspeaker outside the window, and when the demonstrator talked into that transmitter the loudspeaker would tell the crowd outside what it was all about. It was very successful. We sold many thousands of instruments for that purpose. No. 11 is a photograph taken at Washington, D. C., and shows a part of the large crowd which listened to the Victory Loan demonstration, at which I was present. I gave the demonstration on the ground and controlled the operation of the Magnavox loudspeakers. Mr. Metcalf was the aviator who flew at a height of 2,000 feet and talked by radio from the aeroplane to the

(Testimony of Edwin S. Pridham.)

ground. This radio was reproduced on Magnavox equipment and broadcast by acoustical sounds to the very large crowd, estimated at maybe 50,000 or 60,000 people. I was not present at the next photograph. It simply indicates the various uses to which the Magnavox was put. It shows General Booth, of The Salvation Army, using Magnavox equipment for some dedication. The next picture shows General Booth talking into the transmitter with the Magnavox loudspeaker reproducing his voice.

Q. Do you remember when that was?

A. That was in 1921. The next picture simply shows Magnavox equipment being used for [224] public address work. The next picture shows Mr. Hoover, who was then Secretary of Commerce, addressing a large crowd of people at the dedication of the Baby Hospital in New York City. I was present at that demonstration and installed the equipment, and instructed President Hoover (or Mr. Hoover, as he was at that time; he was then Secretary of Commerce), how to use the equipment. I might say that these photographs are simply to illustrate the wide use to which the Magnavox loudspeaker was put in the days before the radio broadcasting became popular.

(The group of photostats of photographs identified by the witness was then offered in evidence, and objected to on the same ground as urged in connection with Plff's. Ex. 9. Ob-

(Testimony of Edwin S. Pridham.)

jection overruled and exception noted. The several photographs were marked "Plff's. Ex. 10.")

In these various instruments shown in the photographs and newspaper clippings, a horn was used. The horn, if it is properly designed, introduces no components into the sound. It is well accepted in theory and fact that the horn, if made of proper material so it will not bend out of shape or vibrate, introduces no component or sound of itself; that is, if there is a distorted sound coming out of the soundbox there is no kind of horn that is made that will undistort that and make pure tones come out if impure tones are in the soundbox; small diaphragms are generally used with horns so that the content of the horns, which is air, the apex of that air, rests upon the diaphragm; the diaphragm gets a grip upon that air and simply expels the air from the horn. There are many and various types of horn used. The latest type, which has been very successful, is called the exponential horn. The term "exponential horn" simply means that there is a certain ratio of cross-section of the horn to the taper at any point, to get the most perfect conical section of air resting upon the diaphragm. [225]

Q. In your discussion of that subject, have you made any charts to illustrate the points which you are referring to?

A. This is the variation in forms of soundbox; is that what you wish, Mr. Loftus? The

operation of the horn, as I said, simply controls the volume of air which the diaphragm sets into vibration. It is practically identical in its function with a cone. The cone has been said by the defendants to be not a diaphragm; but throughout the art, and even in Mr. Kellogg's patent, he calls for a conical diaphragm. It is well known in the art that diaphragms may be flat or conical. The conical diaphragm simply has the air inside of that cone and forces it out into the air. A flat diaphragm simply grips the air and pushes the air out. The actual difference, if any, between a cone and a diaphragm is simply a matter of mechanical rigidity. When a very light diaphragm is used it necessarily must be of mechanical rigidity and made in a conical shape. However, flat diaphragms of large size, of equal size of the present-day cones, have been made and have proven very satisfactory. They are shown in the art.

Q. Have you had any actual experience in the operation of smaller-sized diaphragms, such as shown in either of the patents in suit, fitted with a ferrule or opening at the center constituting the top of the sound-box, and testing that without the use of a horn?

A. I have made many thousands of experiments in the laboratory in my past 20 years' experience on the operation of the diaphragms. In the laboratory we have used diaphragms with horns and without horns, small diaphragms, large diaphragms, conical diaphragms, diaphragms supported in al-

most every imaginable way. From my practice and experience I know positively that a diaphragm, if made of a certain definite size, equal to the conical diaphragm operated in the same way, will produce identical [226] results. We have tried these many times in the laboratory, and I have had very successful results in using flat diaphragms and conical diaphragms without ferrules, and even with ferrules.

The COURT: Q. Mr. Pridham, will you name the elements contained in a successful dynamic loudspeaker?

A. The elements contained in a successful dynamic loudspeaker consist of a magnetic structure in which there exists a narrow air gap. There must be means to hold the poles which form that narrow air gap in spaced relation. There must be a diaphragm mounted upon one of those poles. The diaphragm must, of course, be held in some supporting medium like the rings or soundbox. The coil must extend into the narrow air gap so as to be free to vibrate over its full range without coming in contact with the poles. That diaphragm can be either enclosed or exposed. A horn may be used on the diaphragm or the horn may be dispensed with, according to the size of the diaphragm.

Q. Can you have a successful dynamic loudspeaker without a diaphragm or a soundbox, or their equivalents?

A. It is absolutely impossible to have a successful dynamic speaker without a soundbox and

(Testimony of Edwin S. Pridham.)

diaphragm or their equivalent, and there would be nothing to produce the sound.

Q. When you speak about the spacing means, what occurs if one of these pole pieces should get a little off center and there were no positive means there to control it or keep it in spaced relation?

A. In dynamic speakers it is essential to have a very strong magnetic field existing in the air. If one of those poles should become off center, that is, a little closer to one side or the other, there would be an enormous force of attraction between those two magnetic poles. In some of the modern loudspeakers there is a force existing of practically 20,000 lines of magnetic force per square centimeter in the air gap; that force [227] exerting over three or four square inches would attract most probably a force of 2000 or 3000 pounds. If that pole in there should become loose or get off center, this terrific magnetic attraction which exists between the two poles would immediately crush the coil. Another very disastrous thing would happen if the pole becomes eccentric in that area: The magnetic force on one side would be very much stronger than on the other side, and consequently the coil would become unbalanced in the magnetic field, and instead of having an axial action it would have a diagonal action on the magnetic field, and if the coil moved any distance at all it would strike the pole causing a buzz. That has been the very serious difficulty in the manufacture of loud-

(Testimony of Edwin S. Pridham.)

speakers. One of our greatest troubles in designing the speaker is to get the central core perfectly concentric with the outer core. If it becomes loose in any manner whatsoever you have a defective speaker, and it comes back to the factory and it costs money to replace it.

Q. Turn now to the chart which I handed you, and in connection with that explain your understanding of a soundbox.

A. A soundbox, as known in the art from almost the very beginning, has always seemed to me to mean the enclosure of the diaphragm or the supporting means for the diaphragm. Now, referring to this chart which the draftsman made from pencil sketches which I made, we see the patent to Lumiere, No. 1,036,529. That represents Lumiere's soundbox. It consists of peripherally mounted conical diaphragms; the horn is a short, trumpet-like form, which Lumiere states in his specification may be used or not. The diaphragm is very flexibly supported at its periphery. I have here a physical embodiment of the type of soundbox and diaphragm illustrated in the Lumiere patent. I purchased it in Los Angeles. It was on [228] the market for many years. The soundbox in this device is represented by the supporting rings of the diaphragm. This is the diaphragm which Lumiere has patented in his patent. These rings are supported on the frame of this device. That was quite a successful loudspeaker. I might say that

(Testimony of Edwin S. Pridham.)

the Victor Phonograph Company sold many thousands of speakers using this type of soundbox in connection with the magnetic drive. This particular one had a dynamic drive. I have operated that speaker in the laboratory and it operated very well. (The specimen of Lumiere soundbox and diaphragm was then offered in evidence and the same was marked Plff's. Ex. 11.)

Continuing with my explanation of the chart, the next figure represents a diagrammatic drawing of the Magnavox soundbox, which shows the peculiarly-corrugated diaphragm 2 supported at its edges 3; the ferrule of the horn is shown at 1. When larger diaphragms are used we have found that it is not necessary to use a horn. A term has come into use, which is known as a "baffle"; that baffle is simply a short horn, something like Lumiere shows in Fig. 1. We have shown in the lower left-hand figure what is known as a directional baffle. It is really a short horn with a very wide mouth. The mouth fits the diameter of the diaphragm. This particular type at the present time is sold and is being used for advertising purposes on trucks. Almost any day you can go down on Market Street and see one of those devices mounted on a truck going down the street. When you don't care for a directional horn and wish to have the sound propagated over a wider area, you use a wide baffle with the soundbox and diaphragm as illustrated in the lower right-hand drawing. (The chart referred to by the witness was offered in evidence

(Testimony of Edwin S. Pridham.)
and the same was marked "Plff's. Ex. 12.") [229]

With reference to the prior art that has been discussed here by defendants' expert, the United States patent to Pollak, 939,625, does not refer to a telephone reproducer; it refers to a telephone transmitter. The transmitter buttons are not located in any connection with the magnetizing device at all. Therefore, I hold that that is not a correct reference, because the Claim 8 of the Magnavox patent distinctly states that the combination includes a diaphragm and sound-box mounted upon the outer pole of the magnetic structure. Nothing like that is shown in Pollak.

I would also like to point out the fact that Pollak, while indicating at No. 8 non-magnetic supports for the core, does not in any way say that those are spacing means. Without those supports the core, of course, would fall out of the magnetic circuit, as there are no other means of holding it in there. In addition to that, even if Pollak were considered a telephone reproducer for reproducing acoustical vibrations, it would hardly act as such on account of the very fine metallic strips which are very close to the end of the magnet, and any vibration of the coil at all would immediately cause these strips to hit the magnet and cause a buzz. The coils might vibrate in one direction, but certainly could not vibrate in the other. In relation to Pollak's air gap, he states in his specification that he requires a narrow air gap. In the figure you will notice that there are two air gaps in the magnetic

(Testimony of Edwin S. Pridham.)

circuit, one at either end. There is only one magnetizing coil on the instrument. Therefore, the two air gaps have the effect of being in parallel or demanding twice the area of magnetization that one air gap would have. Consequently, you would have an efficient magnetic circuit for the amount each wire used in the magnetizing coil. You would not have an efficient magnet circuit in that case. [230]

A. In the Lodge British Patent there is not one drawing shown in which a diaphragm and soundbox is mounted upon an outer pole of the magnetic casing where there is spacing means within the casing to separate the two poles. The only description or illustration of a loudspeaker consists of a large sounding-board which is supported, as Lodge states in his deposition, by retort stands which are not in any way connected with the instrument, whatsoever. That is the only loudspeaker that is mentioned in this patent. We know that if any vibration were given to this large sounding-board which is simply supported on retort stands (so far as we know they were perfectly free to move) it would be manifestly impossible to keep that coil in the magnetic field; it would jump around and vibrate. There are other means shown for holding it in any fixed relation with the air gap. There are no means shown in Lodge's patent where a magnetic casing with a central pole is held in spaced relation with an outer pole, and where the soundbox and diaphragm is mounted on the outer pole, as called for in Claim 8 of the Magnavox patent.

At this stage of the proceedings plaintiff offered in evidence the depositions of Sir Oliver Lodge and Edward E. Robinson, taken in London. The same were admitted and deemed read in evidence. The several exhibits attached thereto were also offered, and received in evidence and marked as follows: The Lodge instrument was marked Plff's. Ex. 13; the retort-stand was marked Plff's. Ex. 14; and the annular coil was marked Plff's. Ex. 15. [231]

DEPOSITIONS taken in London, England, on the 3rd, 4th and 11th days of December, 1931, before Russell M. Brooks, Consul of the United States of America, acting under a commission issued out of the United States District Court for the Northern District of California, at San Francisco.

DEPOSITION OF EDWARD E. ROBINSON,

a witness on behalf of Plaintiff:

Direct Examination by Mr. Dyer Smith:

My name is Edward Ernest Robinson. I reside at Park View, Northcroft, Egham, Surrey. I was 70 years old on the 1st September last. I am Research Assistant to Sir Oliver Lodge and have been since 1885. In December, 1898, I had a kind of dual occupation. I was both his Lecture Assistant and his general assistant in fact. I am a little bit deaf. The paper you hand me (marked Defendants' Ex. 6) is a copy of part only, of the Paper read by Sir Oliver Lodge, entitled "Magnetic Space Telegraphy," this being read before the Institution of Electrical Engineers at London, 8th December, 1898. I was quite familiar at that

(Deposition of Edward E. Robinson.)

date (December 8, 1898) with apparatus illustrated in the Paper as forms of vibrating coil telephones. I refer particularly to Figures 6, 7 and 8 in the Paper. My employment with Sir Oliver Lodge was in his Laboratory at Liverpool at that time. That was a Laboratory connected with Liverpool University.

Apparatus, similar to that illustrated in the Figures referred to had not all of it been made in our Laboratory. The magnet shown in Fig. 6 is a large electro-magnet used for optical experiments and in other general work, lecture work, and general laboratory work. It was not made especially for these experiments. But apparatus of the general character at least, represented by these Figures, was in the Laboratory at Liverpool at that time. That does not apply to what comes later in the Paper. Those particu- [232] lar instruments in Fig. 6 were in existence at the time. The electro magnet shown in Fig. 6 together with the two pole pieces. The pole pieces had a hole drilled through their centre for optical experiments. That is all of that piece of apparatus that was really in existence before these experiments that we are talking about. The remainder of the apparatus shown in Fig. 6 was made up ready for experiments in the Laboratory before this Lecture by Sir Oliver Lodge.

Q. 13. Please now refer to Fig. 7 of Sir Oliver's Paper which we are discussing and state whether or not this is an accurate representation of a form of Sir Oliver's sound-board telephone

(Deposition of Edward E. Robinson.)

with which you were familiar at that time?

A. 13. I cannot say that I actually have very much memory of that particular form. I do not remember clearly the existence of that form of telephone.

Q. 14. Have you any recollection whatever of ever seeing a piece of apparatus in the Laboratory or elsewhere exactly corresponding with that Fig-Fig. 7?

A. No.

Q. 16. Please describe the actual apparatus in the Laboratory with which you were familiar which was most similar to the apparatus illustrated in Fig. 7?

A. Well, the loud speaker that I made up to Sir Oliver's instructions consisted of a movable coil fixed to a board about 4 ft. square and about ⅜" in thickness; it may have been as much as ½", but that was about the size of it, and this coil was capable of moving in an annular gap of an electro magnet. I think that describes it.

Q. 17. How was the board supported?

A. 17. It was supported on three iron rods capable of adjustment for height in order that the coil could move freely in its annular gap. [233]

Q. 18. What were these three rods mounted on?

A. 18. They were mounted on a table.

Q. 19. Was the electro magnet also mounted on the same table?

A. 19. Yes, it stood on the table. It was placed on the table.

(Deposition of Edward E. Robinsin.)

Q. 20. This photo-print shows a sketch which was made recently by one of Mr. Thornton's assistants. This sketch was made from my description to Mr. Thornton of the apparatus which we have just been referring to. This sketch correctly represents my remembrance of the apparatus which we have just been describing. There is one point that is not quite clear and that is the method of attachment of the moving coil. It is shown clearly in the drawing in the small figure at the right-hand bottom corner of the drawing. Otherwise it is an exact representation of the apparatus as actually used. That is exactly how it was rigged up. As I remember it, the moving coil B was connected to the sounding board C by the spider or tripod having three arms F and the arms F were attached to the sounding board by means of the small ball E and that was fixed at the centre of the board by means of a little screw, fixing the ball rigidly to the large plate, meaning the sounding board C. The supports D merely rested on the table.

Q. 25. And did the sounding board C rest on the tops of these supports D, or was there some rigid conection between supports D and the sounding board?

A. No. The boards simply rested on the tops of the iron rods. There was no rigid connection.

Q. 26. Were the supports D positioned in a circle about the centre of the electro magnet?

(Deposition of Edward E. Robinsin.)

A. That I would not be too sure of because I don't think so. There was no particular care taken; they would be more or less on the circle but there was no particular care. I mean, it was not a very accurate kind of set—not accurately set out at all. They would be about the same distance [234] from the centre of the magnet; they would be practically on the circle but it was of no consequence whether they were precisely so or not.

These supports D were adjustable in height.

Q. 28. I hand you herewith an iron stand which may perhaps be called a retort stand, and ask you if you know what it is?

A. It is the form of stand we used for general purposes in the laboratories. It was used to support the sounding board in the experiment which we are referring to. This stand is one of the actual retort stands which were used for supporting the sound-board C in the apparatus shown in the sketch at the time of Sir Oliver's Lecture in December, 1898 and which are represented by the letter D in the sketch which I still have before me. It has been in my possession all the time. I had it in the Laboratory in Liverpool in 1898 and it has been in my possession wherever I have moved to since then.

(By Mr. Dyer Smith: I now offer in evidence as Plff's. Commission Exhibit No. 1, Robinson memory sketch of Libratory Coil Sound Board Apparatus. I also offer in evi-

(Deposition of Edward E. Robinsin.)

dence as Plff's. Commission Exhibit No. 2, the Retort Stand identified by the witness.)

This is a photograph of the Exhibit just identified. I made that just lately. There is also a 2-foot rule photographed with it to give an indication of its size.

(By Mr. Dyer Smith: I introduce the photograph just identified as Plff's. Commission Ex. No. 3, photograph of retort stand.)

Q. 35. I notice that the sliding rod in the retort stand is screw-threaded at one end. Was the retort stand used with this screw-threaded end uppermost, or lowermost, or was it immaterial which end was up.

A. It was quite immaterial which end is up. [235]

This photograph I took, represents one of the annular gap magnets that was made in Liverpool and also one of the moving coils used with this magnet. These elements correspond to the electro magnet and the moving coil shown in the sketch, Plff's. Commission Ex. 1. To make it clear. It need not be like it, but one of that form was actually used for the Exhibit shown. The actual electro magnet shown in the photograph, since the time of the experiments referred to has been partly in my possession and partly in the Physics Laboratory of Birmingham University. It is true that this represents one of the original electro magnets used in the experiments referred to about 1898. I do

(Deposition of Edward E. Robinson.)

not remember exactly the dimensions of the electro magnet shown. I will bring the actual apparatus here tomorrow.

(By Mr. Dyer Smith: I introduce into evidence the photograph which has just been identified as Plff's. Commission Exhibit 4, photograph of electro magnet and coil.)

Referring again to Sir Oliver's Paper as read at the Institution of Electrical Engineers meeting. I do not know who made the drawings which illustrate this Paper. I was not present at the Lecture; that is, the reading of the Paper referred to by Sir Oliver on December 8th, 1898. I do not know whether any other assistant accompanied Sir Oliver to this meeting of Electrical Engineers. I feel sure that the Lecture by Sir Oliver was illustrated by means of lantern slides. A complete set of lantern slides was made and I believe that they were used in that Lecture. They were made in Liverpool and I feel sure they were made on purpose to illustrate that Lecture of December 8th, 1898.

Referring again to Fig. 7 of Sir Oliver's Paper, this Figure differs from the apparatus which I saw in the Laboratory at that time in the method of fixing the plate—the vibrating plate. [236] And by "vibrating plate" I mean the sound-board shown at E in the Figure. The sound-board or plate E seems to be mounted in Fig. 7 by means of pins resting on top of the top plate S of the electro magnet. I do not remember seeing that kind of

(Deposition of Edward E. Robinson.)

support. I remember seeing apparatus of this character in which the sounding board was as small in diameter or width as the board illustrated in Fig. 7. As a sounding board we used all kinds of things; in one case we used a tambourine, and also used the body of a violin; and in place of the 4-foot board we used various sizes of board much smaller than that; the 4-foot board was the largest I remember our using.

In the actual apparatus I was not familiar with the method of supporting the coil from the sounding board shown in Fig. 7.

Q. 54. Omitting Fig. 7 from consideration, was the remainder of the apparatus, which is illustrated in Sir Oliver's Paper, actually made up in the form of demonstration apparatus at Liverpool before this Lecture? Everything shown in the Paper?

A. Yes, it was made up for experimental purposes; it was made at the Laboratory.

Q. 55. These various experimental models must have taken up a great deal of space, I suppose?

A. Yes; they did, of course.

Q. 56. Were some of them heavy?

A. Yes, some of them were very heavy. The apparatus shown in Fig. 6, for example, of the Paper, was very heavy. It was a big electro magnet. My impression is that none of this apparatus was taken from the Laboratory to London for the purpose of illustrating Sir Oliver's Lecture.

(Deposition of Edward E. Robinson.)

Fig. 7 of Sir. Oliver's paper is similar to Fig. 5 of an account of the Lecture given in the "Electrician" on 6th January, 1899, a copy of which I have here, apparently being marked Defs'. [237] Ex. 5. I notice that this illustration has dimensions marked thereon. I do not know what this dimensioned drawing was made from. To my knowledge working drawings were not made of the various pieces of apparatus such as that illustrated in Fig. 5 of the "Electrician" or Fig. 7 of the Paper itself as read before the Institution.

Referring to the apparatus shown in my sketch, Plff's. Commission Ex. 1, there was made up a number of variations of this apparatus. In principal they were the same in construction; they were the same, but they were differently wound and the dimensions different. There were quite a number of annular gap magnets made up. They were all wound differently. These annular gap magnets were made up—a great many of them. Some as electro magnets and others as permanent magnets. There would be at least a dozen of them, may be more.

Q. 63. Were any commercial models made?

A. That is a difficult question. The models that were made up were made for Sir Oliver's experiments on telegraphy. They were made up for telegraphy and I do not think that that ever reached a commercial stage.

Q. 64. Referring again to the sketch, Plff's.

(Deposition of Edward E. Robinson.)

Commission Ex. 1, how was the moving coil centred in the gap for demonstration in the experiments?

A. Well, that was quite an easy matter. Its height was adjusted by means of the stands D and the sideway movement was got by just shifting the top board with regard to the stands. It was quite a simple matter. You do it like that (demonstrating) and simply move it so (the witness here poises a paper horizontally and moves it horizontally).

Q. 65. It was all done by eyesight, then, I take it?

A. All, yes.

Q. 66. Referring again to the sketch, Plff's. Commission Ex. 1, [238] to get it clear; do I understand correctly that the moving coil B was attached to the sounding board in the apparatus with which you are familiar in the manner shown in the small Figure at the right-hand side of the sketch and not in the manner shown in the small Figure at the left-hand side of the sketch which represents the coil B directly connected to the sounding Board?

A. It is quite right. It was connected as shown in the right-hand bottom corner.

Cross-Examination.

By Mr. Basil Drew:

I have not yet ceased being an assistant to Sir Oliver. I still do some work for him and Sir Oliver is still doing some research work. This

(Deposition of Edward E. Robinson.)

drawing which is Plff's Commission Ex. 1 was not actually made by myself. It was made according to my approval, and I approved of it.

XQ. 72. When it was put in as an exhibit it was called "Vibratory Coil Sound Board Apparatus." When that name was put to you, you described this in a different way. Do you remember?

A. I remember how I described it.

XQ. 73. Will you please tell me what you called this—this apparatus shown in the drawing?

A. I called it a Lodge loud speaker, if I remember rightly. I don't know that Sir Oliver Lodge took out a patent which covered the devices shown in the illustrations in the Paper read before the Institution of Electrical Engineers. You ask me to look at a copy of Sir Oliver Lodge's British Patent Specification No. 9712 of 1898 which I believe to be Defs'. Ex. 19. I don't remember having seen it. The Specification is dealing with the apparatus described and illustrated in the report of the Paper read before the Institution of Electrical Engineers. On Page 1, line 35, of this Specification it says: "The final telephone of the series is usually a loud speaking iron disc or diaphragm telephone." [239]

On page 2, lines 1, 2 and 3, it says: "I call it a bellowing telephone because a gentle tone at one end of the series becomes a shout at the other end."

(Deposition of Edward E. Robinson.)

In this Specification Sir Oliver Lodge is speaking, in some instances, of a single telephone receiver, and in other instances of a series of receivers for magnifying the sound. The passage I have just read may be dealing with the final telephone of a series.

XQ. 80. My question to you is this; are the terms used "loud speaking" and "bellowing telephone," terms which would be applicable to the sound which it would be possible to produce under certain circumstances with the instrument shown in the sketch, Plff's. Commission Ex. 1?

(By Mr. Dyer Smith: I object to the question as somewhat indefinite and as hypothetical.)

XA. 80. I have got to give you the actual facts. That (pointing to Plff's. Comm. Ex. 1) loud speaking telephone was not used, as far as I can remember, in these experiments at the end of a series of magnifiers. The telephone that was used was one made by Muirhead & Company and a diagram of it is shown in one of the other papers. In the experiments where a series of magnifiers were used, the final telephone was of the form illustrated and described on page 843, Fig. 12 of the Paper read before the Institution of Electrical Engineers.

XQ. 82: Now, Mr. Robinson, my question has nothing to do with the use of the apparatus shown in Plff's. Comm. Ex. 1 as the last of a series; my

(Deposition of Edward E. Robinson.)

question is, was the noise, the sound, which that apparatus could be caused to give however used by itself as apart from being the last member of a series, one which could be called loud speaking or bellowing? [240]

(By Mr. Dyer Smith: I repeat my objection to the question as to the hypothetical quality of the same involved in the words "could be used" etc.)

XA. 82. I rigged it up as a loud speaker for Sir Oliver at his suggestion.

XQ. 83. Did it, in fact, function as a loud speaker?

XA. Yes, it certainly did.

XQ. 84. When it was used in this way what were the nature of the currents which were supplied to it?

XA. They were supplied through a microphone connected directly with the moving coil of the—— (answer not complete).

There was no amplification or similar device between the microphone and what you call the loud speaking telephone.

XQ. 86. Will you describe how loud a sound was given off under those circumstances by the apparatus illustrated in Plff's. Comm. Ex. 1?

(By Mr. Dyer Smith: I must object to this whole series of questions unless it is made to appear from the witness that the loud speaking experiments to which he is referring were

(Deposition of Edward E. Robinson.)

connected with the publication, namely Sir Oliver's paper, read before the Institution of Electrical Engineers.)

XA. 86. Well, when connected with a microphone the speech is quite loud. You could hear it all over this room, for instance, quite comfortably. It is not as loud as—There is no real magnification. It is not as loud as a person's speech, naturally.

XQ. 87. Mr. Robinson, you say it would be heard all over this room. Would you agree that this room is about 12 ft. x 15 ft. x 16 ft. high?

XA. Yes, I should think it is a little more.

XQ. 88. Would you go so far as to say this, Mr. Robinson; that this apparatus gave off a sound which would be clearly audible all over any ordinary domestic room?

XA. 88. Yes. [241]

XQ.89. Following Dr. Lodge's Paper on December 8, 1898, a Paper was read by Mr. Evershed on December 22, 1898, in which he refers to Dr. Lodge's Paper of Dec. 8th. I ask you to look at Page 892 of the Journal of Electrical Engineers where Mr. Evershed says: "I feel sure the moving coil telephone will ultimately displace the telephones now used, not only for motor work, that is to say, for induction telegraphy, but also for speed. It is clear from what we all heard of Dr. Lodge's telephones that they are almost equal to the ordinary patterns as speech instruments and,

(Deposition of Edward E. Robinson.)

electrically, they are infinitely superior." I now want to show you one further passage. On Page 911 of the same Journal, Mr. Sennett in the discussion on these two papers said: "Professor Lodge touched upon and demonstrated to us with his remarkable loud speaking relay micro-telephones, the characteristic sound which it is well known that every telephone possesses, and which detracts so much from the efficiency of the instruments."

XA. 89. Yes.

XQ. 90. Do you still think that Dr. Lodge gave no demonstration when he read his Paper?

XA. I cannot say. I don't remember.

XQ. 91. You do not remember whether he did or not?

XA. No. He will probably be able to answer that question, but I cannot say definitely.

XQ. 92. You said that the apparatus shown in Plff's. Comm. Ex. 1 was made up with varying sizes of sound board?

A. Yes. The largest sound board I recollect was 4 feet square. The very smallest sound-board I can recollect was in size about 18″ by about 11″. I don't remember it being used with a smaller sound board than that. Looking at Fig. 7 on page 838 of the Journal of the Institution of Electrical Engineers, this illustrates a telephone substantially similar to that shown in Plff's. Comm. Ex. 1, [242] except that the sound-board is smaller; the attach-

(Deposition of Edward E. Robinson.)

ment of the sound-board to the coil is like that shown on the left of the sketch rather than that on the right, and the support of the sound-board is different. Underneath the drawing appears: "Another form of sound-board telephone, with the receiving coil surrounding one pole of the magnet, and surrounded by the other pole. The coil attached direct to sound-board E". Nearly at the bottom of the page appears these words: "Another form was then made with a magnet specially designed as shown in Fig. 7".

XQ. 99. Do you say that such an instrument was not constructed or that you do not remember it?

XA. I don't happen to actually remember it.

XQ. 100. Now will you look at page 367 of the "Electrician" for 6th January 1899 at Fig. 5?

XA. Yes, that's the same thing there.

XQ. 101. I want you to compare the Fig. 7 of the Journal and Fig. 5 of the "Electrician." Are the dimensions in these two figures the same, or different?

XA. Well, of course, I would say probably they are the same.

XQ. 102. As drawn, do the dimensions appear to be different?

XA. Why yes, they do. This is a long magnet, and this a comparatively short one compared with this (pointing to the Figures).

(Deposition of Edward E. Robinson.)

XQ. 103. Would you look at Fig. 5 of the Journal. Do you see that the dimensions are given?

XA. Yes.

XQ. 104. As actual dimensions are given, would you not suppose that this drawing was made from an actual instrument?

(By Mr. Dyer Smith: I object to this question as calling for a supposition merely, which is not evidence.)

XA. 104. Yes.

XQ. 105. As accurate dimensions are given would you not suppose that this figure is drawn from an actual instrument? [243]

XA. 105. Certainly I can think nothing else. Obviously it was taken from an instrument.

XQ. 106. Do you see, in the top right-hand corner of the drawing, there are the words: "Three supports"?

XA. 106. Yes.

XQ. 107. With an arrow?

XA. Yes.

XQ. 108. What do these supports appear to be?

XA. Well, they might be metal pillars, or anything of that kind.

XQ. 109. What is the purpose of these supports?

(By Mr. Dyer Smith: This question also is objected to since the witness is being asked to state the purpose of apparatus which he says he has never seen.)

(Deposition of Edward E. Robinson.)

XA. 109. Yes, well—I didn't say I had never seen it; but I don't remember seeing it. Did I answer your question?

XQ. 110. What is the purpose of those supports?

XA. Why, to support the vibrating plate.

XQ. 111. Do those supports serve the same purpose as the supports D in Plff's. Comm. Ex. 1?

(By Mr. Dyer Smith: Same objection.)

XA. 111. Yes, they must do.

XQ. 112. If a magnet structure, such as that shown in Plff's. Comm. Ex. 1 is used with a small sound-board of a diameter similar to that of the magnet structure, or not very much greater, would it be possible to use supports such as D in Plff's. Comm. Ex. 1?

(By Mr. Dyer Smith: Please note that my objection to all questions of a hypothetical character to this witness are objected to and this objection is to be understood as being repeated for all questions of that general character.

By Mr. Basil Drew: These questions are being asked the witness, not only as a witness of fact, but also as an expert concerned with experiment in this field of science.) [244]

XA. 112. Might I just say one thing? You can ask the question afterwards as you like, or not; but you are talking about two instruments. You are talking about that one (pointing to Plff's.

(Deposition of Edward E. Robinson.)

Comm. Ex. 1) and you are talking about this (pointing to Fig. 5 of the "Electrician")—they are two different instruments; that is a Lodge loud one (pointing to Plff's. Comm. Ex. 1) and that is not (pointing to Fig. 5 of the "Electrician".)

XQ. 113. Mr. Robinson, can you now answer my question?

XA. Would it be possible to use those supports? No.

XQ. 114. Now, Mr. Robinson, you have said that Fig. 5 of the "Electrician" was not a loud speaker?

A. Yes.

XQ. 115: May I read you what is said about it in the "Electrician":

(Mr. Drew read the last paragraph on page 366 and the first column and a half on page 367.)

Does the reference at the end of this passage to the present plan of a large sound-board and a light coil rigidly attached to a point at its middle by either a light tripod or a light cone, refer to a device like that shown in Plff's. Comm. Ex. 17.

A. Yes.

XQ. 116. On reading this passage, do you recollect Fig. 5 as being an earlier form of the receiver which you describe?

XA. Well, I am afraid it makes me look rather obstinate, but I don't remember it, though it is perfectly evident that it was in use. You see,

(Deposition of Edward E. Robinson.)

where it was, when I rigged up that form (the form in Plff's. Comm. Ex. 1) for Sir Oliver, I was interested in that form. What I was interested in was the construction of a loud speaker. The apparatus shown in the figure is not a loud speaker. It is referred to as a sensitive type of telephone equal to the Collier and no doubt it was if you put your ear on the board. You couldn't describe the Fig. 5 form as a loud speaker any more than you could a Collier. [245]

(By. Mr. Dyer Smith: I do not wish to seem to be making too many objections, but I must enter an objection to that part of the witness's answer reading: "It is perfectly evident that it was in use," since this statement is evidently a conclusion.)

XQ. 117. Mr. Robinson, you have said that a large number, a dozen or more, annular gap magnets were made at that time. Is that correct?

XA. Yes; not a dozen or more of that altogether (pointing to the one shown in Plff's. Comm. Ex. 1). Some of those and one or more like Fig. 9 and one or more like Fig. 17 in the Journal of the Institution of Electrical Engineers. They take a lot of different forms; there are no two alike of them. Both electro magnets and permanent magnets. There were certainly four made with a single annular gap of the general shape of that shown in Plff's. Comm. Ex. 1, and there may have been more; but there were four, if I remember. The four differed in size; they also differed in the pri-

(Deposition of Edward E. Robinson.)

mary windings and also the moving coils differed. The primary windings differed both in the number of wires and the diameter of the wire. The moving coils differed enormously; some were made up of an aluminum tape with a very, very small resistance and others were wound with aluminum wires of various sizes. There were also moving coils made of very thin copper wire. They were different in all kinds of respects. They were used as experimental things and naturally enough they were made up in all sorts of sizes. I made up one that was used in Liverpool and that was used to give a demonstration. I can remember that various people used to drop in from time to time.

XQ. 124. Do you remember demonstrations being given in Liverpool?

XA. It is a funny question really, because if Sir Oliver happened to have some friends there to whom he wished to [246] show the loud speaker I used to rig it up on the table; I got on top of a set of cupboards and got it down; got two or three retort things and the whole thing was rigged up in 3 or 4 minutes. That is what I mean by demonstration. I gave a demonstration with it in Birmingham somewhere between 1902 and the beginning of the War. That I could get for you because it is in their conversazione programme, The Midland Institute.

(By Mr. Dyer Smith: I am afraid I must object to questions and answers referring to

(Deposition of Edward E. Robinson.)

demonstrations or anything done subsequently to Sir Oliver's Paper of 8th December 1898 and which demonstrations are not described in any printed publication or patent in evidence in this case.)

I cannot recollect the date nearer than 1902 and the War. I think it is very unlikely that Sir Oliver was present on this occasion. I demonstrated this as a loud speaker and it worked on this occasion. I don't know of any other demonstrations anywhere else of this loud speaking telephone.

XQ. 133. How many of these magnets are in existence to-day, so far as you know?

XA. Let me see now; I want to know whether you mean these magnets to apply to that particular loud speaker. There was only the one loud speaker. It could be rigged up with any one of those magnets if you liked. It did not matter a bit which of the magnets you used to rig up the loud speaker with, but we only had one loud speaker at a time.

XQ. 134. Which was it? You had several different sizes of sound-boards at different times?

XA. Yes, but the one I used was a 4-foot one.

XQ. 135. How many of these annular gap magnets are there in existence to-day?

XA. I know of several, and yet I cannot very well be said to know of any. I know of one that I have got at the [247] Works; I have got two at the Works; and I know, or think there are, some at Normanton with Sir Oliver. They are all about

(Deposition of Edward E. Robinson.)

the place; they have been lent. They were lent during the War, to, I think it was, Professor Bragg, for experiments during the War; nothing to do with telegraphy.

These magnets were made in various sizes. They varied in height and they also varied in diameter pretty well in every way. They varied in the amount of winding and the diameter of the inner core. They varied in the diameter of the internal gap from about 3½" to something like an inch or 1¼". They varied in every conceivable manner. I believe there is one of these magnets in the South Kensington Museum.

XQ. 140. Were these magnets used for any other purpose than for reproducing signals or speech?

XA. 140. Their principal use was for reproducing signals. Very little indeed as far as speech was concerned. They were mainly used for signalling purposes.

XQ. 141. Were they used entirely, or mainly, for producing sounds which were to be audible in a room?

XA. No. No. They were not used by any means mainly for speech. I would not say that was the chief use; the chief use was for working up the power to a sufficient degree to be able to record messages on ordinary telegraph tape. That was their principal use. As far as sound was concerned, I don't remember that they were used for that purpose to any extent.

(Deposition of Edward E. Robinson.)

XQ. 142. Except in the loud speaking experiments of which you have told us?

XA. Yes. As far as I remember it was more a receiver to do with telegraphy. You say that Paper deals with telegraphy and also loud speaking, but the main Paper concerns telegraphy.

The illustration in Fig. 5 on page 367 of the "Electrician" shows an accurate representation of the magnet structure used in [248] the annular magnet coil of which I have been speaking. The two magnets which I have in my possession are constructed in the manner shown in that Figure.

XQ. 145. In such a magnet is it desirable to have the inner pole of the magnet definitely retained in a concentric position so as to maintain an annular gap between it and the outer pole of the magnet?

XA. I don't quite understand what you mean. Yes.

XQ. 146. In the drawing before you, is the inner pole kept in position by the upper head of the spool of the magnet?

XA. No.

XQ. 147. How is it kept concentric?

XA. It is bolted on to a strong base.

XQ. 148. Will you tell me how the central bolting is done. Has this any relation to the outer pole?

XA. It is fixed by means of a bolt to a thick iron plate which forms the base of the magnet. You

(Deposition of Edward E. Robinson.)

see, there it is (pointing to Fig. 6). The base is connected to the outer pole by an iron casing.

XQ. 151. Mr. Robinson, would the loud speaker shown in Plff's. Comm. Ex. 1 operate as a loud speaker in the modern sense of the term?

(By Mr. Dyer Smith: The question is objected to as obviously hypothetical.)

XA. 151. Yes.

XQ. 152. To put the question in another way: If you fitted a sound-board to the magnet structure now in your possession, could it be used as a loud speaker?

XA. Yes. It could of course—as shown in the picture it would be rather a clumsy one, but it could be.

XQ. 153. If a modern cone was attached to the moving coil shown in that picture would you get satisfactory loud speaking from a modern wireless set? [249]

(By Mr. Dyer Smith: My objection is to be considered as continuing for all this type of questions.)

XA. 153. Yes.

Redirect Examination by Mr. Dyer Smith.

RDQ. 154. Mr. Robinson you answered in cross-examination that you rigged up the apparatus shown in Plff's. Comm. Ex. 1 as a loud speaker and that it functioned as such, if I remember. I am not sure that I remember whether you answered

(Deposition of Edward E. Robinson.)

definitely with regard to the time of any such demonstration as a loud speaker. Can you state, positively, and of your own knowledge, whether any such demonstration was before the lecture of 8th December, 1898, or not?

RDA. Not absolutely definitely, but I think there is not the slightest doubt that it was made up before that Lecture was actually given because there is a drawing of the loud speaker in the proceedings of the Society (Fig. 8 of the Institution Paper) and that would not be there if the loud speaker had not been actually constructed.

RDQ. 156. I understand you correctly then, do I not, that you have no positive knowledge that this device as shown in Fig. 8 was demonstrated as a loud speaker prior to 8th December 1898 at any place?

RDA. I have no definite knowledge. No.

Re-Cross Examination by Mr. Basil Drewe.

Fig. 8 of the Paper before the Institution of Electrical Engineers is the same as the drawing (Fig. 1) of the Patent Specification No. 9712 of 1898.

The same device is also shown in Fig. 12 of the "Electrician" on page 404. There is one thing about the whole of that, it does not show the coils. It shows the coil nowhere. It is an annular gap magnet. It obviously is the same also. Yes, they are the [250] same all through, of course. Fig. 2 of the Patent Specification No. 9712 of 1898 shows

(Deposition of Edward E. Robinson.)
the internal construction of a similar apparatus. I remember an apparatus being made similar to Fig. 1 of the Patent Specification with the internal arrangement shown in the lower part of Fig. 2. I remember that one together with the others. (Examination closed.) [251]

Deposition of

SIR OLIVER LODGE, F. R. S.,

residing at Normanton, Lake, Nr. Salisbury, a Scientist, aged 80 years and upwards, a witness produced on behalf of the plaintiff.

Direct Examination by Mr. Dyer Smith:

Q. 1. Sir Oliver, I believe I am correct in saying that you are a Fellow of the Royal Society; Doctor of Science of London University; that you hold various honorary degrees from various Universities; that you were principal of the University of Birmingham from 1900 to 1919; Professor of Physics, University College, Liverpool, from 1881 to 1900; Rumford Medallist of the Royal Society in 1898?

A. Either 1898 or 1899; I think it was 1898.

Q. 2. And that at other times you were President of the British Association in 1913; President of the Physics Society of London in 1899; that you were the Romanes Lecturer, Oxford, in 1903, and also that you were the Albert Medallist of the

(Deposition of Sir Oliver Lodge, F. R. S.)

Royal Society of Arts as a pioneer of wireless telegraphy in or about 1919?

A. Yes.

Q. 3. On 8th December, 1898, you read a Paper, did you not, before the Institution of Electrical Engineers in London on the subject of improvements in magnetic space telegraphy?

A. Yes.

Q. 4. I hand you a paper marked "Defs'. Ex. 6" which seems to be a partial copy of the Paper which you delivered on that occasion as printed. I take it that you recognize the Figures in this Paper, particularly Figs. 6, 7 and 8, as the illustrations used in that Lecture?

A. Yes.

Q. 5. Can you state whether the Lecture was illustrated by lantern slides, or whether you demonstrated actual apparatus, or both?

A. I don't think that I had my assistant up for this Lecture as far as I can remember and therefore I should be only taking lantern slides. Any demonstration I had given was in [252] Liverpool, but I took up lantern slides for this purpose and did not make an experimental demonstration.

Q. 6. Will you please look at Fig. 7 of this Paper?

A. Yes. I call that a sound-board telephone where I show the principle of the moving coil. The only thing I attached importance to was the moving coil in a magnetic gap. I don't call that

(Deposition of Sir Oliver Lodge, F. R. S.)

a magnetic speaker, I call that a sound-board telephone. That particular one would be one for applying my ear to, rather than as a loud speaker. A loud speaker would have a much bigger sound-board than that. In my Paper I believe I emphasized the size of the sound-board as an important part of the loud speaker.

Q. 7. Have you any clear remembrance whether one or more pieces of apparatus were actually constructed in accordance with Fig. 7?

A. I think it must have been constructed, otherwise it would not have been drawn here. I should think it was. I have no very clear recollection of that one. I think the signs are that it was constructed. "Another form was then made with a magnet specially designed as shown in Fig. 7." That is what it says there.

Cross-Examination by Mr. Drewe:

I have not looked recently at my Patent Specification No. 9712 of 1898. I see that many of these Figures have to do with the syntonic sort of tone telephone whereby a very feeble disturbance could be picked up and magnified by a succession of microphones, but they were mostly not for talking but for hearing a special tone. There was a tuning fork in some of them, so that it would not respond to any but a particular tone.

Q. 10. I appreciate that Sir Oliver. Can you tell me or not whether all the devices shown in those Figures were constructed?

(Deposition of Sir Oliver Lodge, F. R. S.)

A. It is difficult to know, but I know that the tuning fork one was constructed; Fig. 8 was constructed and several of these shown in [253] Fig. 6. No. III is very like Fig. 1. I do not know that it was constructed in precisely that form, but the principle of it was constructed. It was constructed as shown by the apparatus produced by Mr. Robinson. I don't remember IV being constructed. I remember I, II and III. I had them in my Laboratory at Normanton House for some time—a whole series of these, but I have not got them now because I sent them to the War to see if they would do for the sound detection apparatus. The gun location arrangements. There was a gun location arrangement; they tried to get a sensitive device for hearing and recording the sound of a gun at several stations simultaneously so that from the delay in receiving the signals at different distances, they could estimate the position of the gun. This sound location was very successful afterwards but they used a different microphone—a different receiving instrument—which was simpler and better than those I sent.

XQ. 14. I want now to refer you to two or three passages in the body of your Specification. I will ask you to read pages 4 and 5 of the Patent Specification, and also lines 43 to 45 on page 6.

XA. Very well. I am glad to have seen it again.

XQ. 15. Can you tell me now whether you made and used a device of the structure shown as No.

(Deposition of Sir Oliver Lodge, F. R. S.)

III of Fig. 7 and, if so, can you state the size of the sound-board D at any time?

XA. I don't discriminate between that III and Fig. 1. I certainly made a thing like Fig. 1.

XQ. 16. At that date, Sir Oliver; about the date of the Specification, or earlier, or later?

XA. What is the date of the Specification, 1898?

XQ. 17. April, 1898 is the date of the application, and the date of the complete Specification is 13th December, 1898; and your Paper is also December 1898.

XA. Well, all the experiments [254] were made about that time and the apparatus would be constructed before these patent drawings were made.

XQ. 18. The patent drawings were left with the complete Specification on the 13th December, 1898. Do I understand you to say that the apparatus in Fig. I would have been made before these drawings were prepared?

A. I should certainly say they were and I should say that they were produced before I gave the Paper at the Institution of Electrical Engineers.

XQ. 19. You see the parts marked little "f" in the drawings; do they serve to space concentrically the inner and outer pole pieces so as to maintain a definite annular air gap for the moving coil?

A. Yes; that is what they are for.

XQ. 20. Was not the said spacing means entirely mechanical to maintain the outer and inner pole pieces concentrically?

(Deposition of Sir Oliver Lodge, F. R. S.)

A. Yes. They were to make an annular space suitable for the coil to be in.

(Mr. Dyer Smith: The object of the Commission, as I understand it, is to enquire into the interpretation of Sir Oliver's Paper before the Electrical Engineers and into the accompanying circumstances. I therefore think that it is not in order to ask the witness to construe his Patent and I object to this series of questions and wish it to be understood that the objection is to be considered as continuing for all questions of a similar nature.)

Fig. 8 on page 839 of my Paper is similar to Fig. I of the Patent Specification. I find there the part little "f" which is brass. Yes, they were made the same way. The answers I have given you about my Patent Specification refer also to Fig. 8 of the Paper. I think the diagrams are practically identical. [255]

XQ. 25. Was not that a simple and well-known expedient for spacing the poles which had no electric or acoustic function?

A. I don't know that I quite understand that question.

XQ. 26. Had the part "f" any electric or acoustic function?

A. No.

XQ. 27. Was its purpose merely to position the poles?

A. Yes; you may see it in Fig. 9.

(Deposition of Sir Oliver Lodge, F. R. S.)

XQ. 28. Of the Paper?

A. Of the Paper. There are two poles; horse-shoe magnet and "f" is to hold the iron part G in position. The iron part G is called the keeper because it serves to carry the magnetic field from one pole to the other.

XQ. 29. Will you please look at the issue of the "Electrician" for 6th January, 1899, particularly Fig. 5 on page 367. Was such a device used to reproduce speech?

A. It is the same as Fig. 7 in the other one. Well, it was certainly made because it says here: "All the iron was well annealed; no attempt was made to subdivide the iron because eddy currents are all to the good. The coil was cemented direct to a wooden disc and by applying the ear to the wood, the first-made instrument on this plan was exactly as sensitive as the best of the usual patterns of telephone." So it was certainly used as a telephone.

XQ. 30. For reproducing speech?

A. For reproducing speech, but I should not call that a loud speaker.

XQ. 31. Would you look once more at the drawing, Sir Oliver? Do you see that actual dimensions are given?

A. Yes, several figures giving dimensions.

XQ. 32. Does the fact of the dimensions being given support your view that the instrument was in fact made?

(Deposition of Sir Oliver Lodge, F. R. S.)

A. Oh, I have no doubt it was made.

XQ. 33. Sir Oliver, in a device such as that in the Figure it [256] would be desirable, would it not, that the inner and outer pole pieces should be definitely retained in concentric position so as maintain an annular air gap for the moving coil?

A. Oh certainly the magnet portions would be fixed.

XQ. 34. Can you say how the sound-board is fixed in that drawing?

A. It seems to be fixed to a base-board.

XQ. 35. Would the base-board be metal?

A. Ah, I see now. There is an iron base at the bottom of it which is fixed to the base-board. The core is iron and the base is iron and the cylinder round is iron; it is all part of the magnet.

XQ. 36. Does the bolt which bolts the central core of the iron base-plate retain the central core concentrically within the outer pole?

A. Yes, it does. Quite firm.

Fig. 5 in the "Electrician" and Fig. 7 in the Paper I should not say were different. I think that Fig. 7 is the better picture, the shading is better, it shows that it is iron, whereas the other is left rather blank.

XQ. 38. On page 367 of the "Electrician" you stated, relative to the device shown in Fig. 5, that you considered as a syntonic receiver it was not successful. The fact that it was not successful as a syntonic receiver was no indication that it would not be successful to reproduce speech, was it?

(Deposition of Sir Oliver Lodge, F. R. S.)

A. No, I do not think so.

XQ. 39. Is it not a fact syntony is neither necessary nor desirable in a loud speaker?

A. Well, you don't want syntony in a loud speaker. You want all sorts of tones.

XQ. 40. Would not the fact that the said device was not successful syntonically indicate that it had characteristics which would make it successful as a loud speaker?

A. Well, I don't know about that, but I was thinking of a call for the syntonic telegraphy. [257]

XQ. 41. For that purpose?

A. For that purpose syntony was desirable. I was not exactly thinking of a loud speaker in connection with that arrangement. What I say is, that as a syntonic receiver it was not successful, the coil was too heavy.

XQ. 42. Now, Sir Oliver, would you look at the Figure again and tell me how the sound-board is supported?

A. Well, I take it that that sound-board is intended to be supported at the nodal lines judging by the letter-press.

XQ. 43. And what were its supports?

A. It was not clamped on its edge. I don't know what the supports were.

XQ. 44. You see on Fig. III the words "three supports" appear with an arrow. Can you explain what these were?

A. I don't remember the construction but it looks as if it were three pegs; three pins.

(Deposition of Sir Oliver Lodge, F. R. S.)

XQ. 45. Would the sound-board rest with its own weight on top of the three pegs?

A. I should think it was made rather more definitely placed than that. You see it has to support the coil and it would not do if it wobbled about.

I have seen the drawing produced yesterday by Mr. Robinson, Plff's. Comm. Ex. 1.

XQ. 47. Do you recollect an apparatus being constructed in accordance with that drawing?

A. I should not call it an apparatus; I should call it a temporary arrangement for a Lecture demonstration. After I had seen this drawing I remembered that kind of thing being shown at Liverpool. I had it in my Lecture room for showing to the students. It was rigged upon a Lecture table with a large board, 3 ft. or 4 ft. square, I should think, and with those adjustable supports holding it, but it was arranged for a temporary purpose. For the purpose of seeing how loud the speaker would be in the theatre. My recollection is that it was a big [258] theatre and you could hear it all over, but that we never got it so loud as one could speak. We got it loud enough to be audible, but not as loud as a man could shout. But what we got was the distinct utterance from it.

XQ. Sir Oliver, Mr. Robinson has told us that this apparatus was demonstrated at a Conversazione of the Midland Institute at Birmingham. Have you any recollection of that?

(By Mr. Dyer Smith: I object to the question as referring to something which, from the

(Deposition of Sir Oliver Lodge, F. R. S.)

previous witness's testimony, occurred years later than the Lecture of Sir Oliver before the Institution of Electrical Engineers, which therefore had no bearing on the subject into which we are supposed to be enquiring.)

XA. I did not go to Birmingham until 1900. The Midland Institute used to have a week's Conversazione at which apparatus was shown. Mr. Robinson was in charge of that apparatus and demonstrated it to the audience that came in, like they do at a Conversazione to hear what is going on throughout the week. It was soon after I had gone to Birmingham. It might have been 1900, 1902 or 1903; I could not say. I do not recollect any other occasions on which this apparatus was demonstrated.

XQ. 51. Was the apparatus shown in that drawing demonstrated to the Institution of Electrical Engineers when your Paper was read?

A. Well, I think not. I think that at the Institution I only had lantern slides.

XQ. 52. I think I ought to show you some remarks which were made during the discussion held after your Paper was read. If you will look at page 892 and page 911——

A. I should think that means that I had shown a telephone with a magnified tone. You see that was with the relay microphones. Well, I don't know what point it is you want there. [259]

XQ. 53. Having read those passages, do you

(Deposition of Sir Oliver Lodge, F. R. S.)
think that you made some demonstration when your Paper was read?

A. Well, it certainly looks as if I had shown the series, each telephone operating a microphone which passed it on to the next and so got a magnified tone at the end.

XQ. 54. Is that a series such as is shown in Fig. 6 of your Patent Specification?

A. Yes—I, II and III.

XQ. 55. What would the last instrument in such a series consist of?

A. I cannot tell. I see no reason why it should not be No. III.

XQ. 56. And No. III is similar to Fig. I of the Patent Specification?

A. Yes it is, but I have no recollection. It is only from what Mr. Sennett says.

XQ. 57. Sir Oliver, would you look just once more at Fig. 7 on page 838 of the Paper?

A. Yes.

XQ. 58. In 1898 did you have available such highly amplified voice currents as are now used in the output stage of a modern wireless receiving apparatus?

A. Well, we were nothing like so advanced.

XQ. 59. If an apparatus such as that shown in Fig. 7 was used attached to the output side of a powerful modern wireless receiver, would it not, in your opinion, give audible sound?

A. It would give audible sound, but it is not

(Deposition of Sir Oliver Lodge, F. R. S.)

adapted for speech. I think it is more adapted for a single tone.

XQ. 60. Sir Oliver, your paper says that it is not successful considered as a syntonic receiver?

A. That is referring to the coil. When the coil was attached to it, it put it out of tune.

XQ. 61. Do you not think that it would reproduce sound if used in place of a modern loud speaker?

A. Oh, yes; it would reproduce sound. [260]

XQ. 62. Which would be audible in the room?

A. I think it would be better if the board was bigger.

XQ. 63. But with the board as shown, would it be audible in the room, in your opinion?

A. I should say it would be audible in the room, but not very loud.

XQ. 64. Looking at Fig. 8 on page 839 of your Paper, would that device with a sound-board as indicated at E give loud sounds sufficient for all ordinary purposes if used in the place of a modern loud speaker?

A. Yes, I should say it would take the place of a modern loud speaker.

XQ. 65. And would be quite successful?

A. Judging by the results that I got at Liverpool it would be quite successful. It would not be very compact. In my Patent Specification page 4, lines 12 to 18 the statement is made that the sound-board might form a ceiling or board of a

(Deposition of Sir Oliver Lodge, F. R. S.)

public hall. By that statement I did not intend to exclude an ordinary sound-board. As shown in Fig. I and Fig. 6 of the Patent, the sound-board is not shown as physically supported.

XQ. 70. Would such support have been necessary if the sound-board did not form an integral part of the building?

A. Anyhow the sound-board would have to be supported somehow. It could not just float like this (demonstrating). One successful method of support is shown in the drawing marked Plff's. Comm. Ex. 1. In Fig. 7 of the Paper another method of support is shown. It is supported on three pins which rest on the magnet instead, as in the other drawing, on the table. I cannot say the pins were in any way connected to the sound-board. I should think that they may have been either screwed in or pegged in to the sound-board.

XQ. 76. If they were attached to the sound-board, would they also be attached to the magnet structure, or would they rest upon it? [261]

A. I would say—if I was making that apparatus now, I should fix it to the sound-board and to the magnet below. That is, I should have holes, into which to put the ends of those pins, but I do not know how it was made really. I didn't attach much importance to the way it was supported.

I identify the piece of apparatus referred to by Mr. Robinson in his evidence as being one of the

(Deposition of Sir Oliver Lodge, F. R. S.)

moving coil magnets I used in connection with these experiments. That was made prior to my paper before the Institution of Electrical Engineers in 1898. I should think it was made partly in preparation for that Paper. It has on the front of it, painted in white, the Roman numeral II. It looks as if it had been used for No. II in Fig. 6 in the Patent. The magnet structure shown in Fig. II of Fig. 6 is similar to—just the same as—that shown in Fig. III of Fig. 6.

(By Mr. Drewe: I introduce the magnet of which Sir Oliver Lodge has just been speaking, as Defs'. Comm. Ex. 1.)

XQ. 84. Was the loud speaker shown at III of Fig. 6 of the Patent Specification provided with a removable annular end, or pole piece?

A. You are meaning the brass "f". I don't know whether it was removable. Yes, I suppose it is removable here (pointing to Defs'. Ex. 1) but it just completes the cylinder.

XQ. 85. At the time of your Patent Specification what arrangement of sound-board was contemplated?

A. I do not think any special arrangement, as far as I remember. Any large surface of thin board would do.

XQ. 88. In your Specification you use the term "pure tone telephony" and the term "speech telephony." Will you tell us shortly what was the distinction?

(Deposition of Sir Oliver Lodge, F. R. S.)

A. For extreme sensitiveness and for magnification I considered that a pure tone would be best for getting the principle of acoustic resonance to work. For speech that would not be possible. [262]

XQ. 87. I will read you Claim III of your Patent Specification: "The method, substantially as set forth, of attaining forcible mechanical or acoustic vibrations from fluctuating electric currents by a telephone consisting of an elastically suspended movable coil, suspended in an annular or other suitable magnetic field, and connected with a sound-board, or its equivalent." Does that Claim define the loud-speaker device?

A. Yes, I should say it includes that.

XQ. 88. And you, in fact, made a loud speaking device within that Claim in or about 1898?

A. Yes.

XQ. 89. Sir Oliver, for identification purposes I want you to say whether these two letters are letters which you have written (handing letters to Sir Oliver).

A. They are both my letters, yes.

(By Mr. Basil Drewe: I introduce into evidence two letters written by and identified by Sir Oliver Lodge, as Defs'. Comm. Exhibits 2 and 3.)

Mr. Benjamin Davies, referred to in my Paper, was my assistant for many years. He is still alive and lives near Aberystwyth. I think it is quite possible that Mr. Benjamin Davies was present

(Deposition of Sir Oliver Lodge, F. R. S.)

when my Paper was read before the Institution of Electrical Engineers. He helped me with many of these series experiments. He would have been in charge of the apparatus. I generally used Mr. Robinson for Lectures, but Davies was specially connected with this investigation and he may have come up. I could easily ask him.

Redirect Examination by Mr. Dyer Smith.

RDQ. 95. Sir Oliver, I will try to make my redirect examination as brief as possible to enable you to catch your train. Do I understand correctly that you have no recollection of the exact [263] form of device illustrated in Fig. 7 of your Paper, read before the Electrical Engineers, apart from what inferences you draw from reading the text of the Lecture, etc., and the "Electrician" publication?

A. Yes, I have to refresh my memory about things that happened 33 years ago. As far as any inference from the dimensions on Fig. 5 of the article in the "Electrician" goes, I think if I read the text adjacent to Fig. 5 in the "Electrician" it is pretty clear that the thing was made because I say "by placing the ear on the wood it was exactly as sensitive as a good modern telephone of usual pattern."

Whether the article in the "Electrician" was written by me, or authorized by me, or what relation it had to the publication in the Journal of the Institution itself, I cannot say. I did write for

(Deposition of Sir Oliver Lodge, F. R. S.)

the "Electrician" about that date sometimes; whether I wrote this I do not know.

RDQ. 98. Referring again to the Paper as it appears in the Journal of the Institution, do I understand correctly, from the text accompanying or describing Fig. 7, that the sound-board was intended to be supported by supports which rested on the nodal circle of the sounding board?

A. They do not rest on them; they support the sounding-board at the nodal circle.

RDQ. 99. And in the Fig. 7 illustration the pins which are represented as supporting the sounding-board may be taken, you think, as being positioned at the nodal circle?

A. Yes, approximately so. The idea was to leave the disc as free to vibrate as possible; not to damp it unnecessarily.

RDQ. 100. That means, does it not, that the disc was to be free to vibrate as freely as possible when a single note was received by the apparatus so that the nodal circle would be in one fixed position which appertained to that particular note? [264]

A. Yes, that would be the primary object, but the same nodal position would come in for many tones. A disc supported at the notes for one tone would respond equally well to higher tones, for the higher tones might have the same nodes, with others supplementing them.

RDQ. 101. But there would also be various

(Deposition of Sir Oliver Lodge, F. R. S.)

other tones having wave lengths different from a multiple of the wave length of the tone for which the particular nodal circle was calculated, in which case the apparatus would not be well adapted to reproduce such tones. Is that not correct?

A. I don't think that one can say that would prevent speech from coming out of it. I judge from what I said here: "The coil was cemented direct to a wooden disc; by placing the ear to the wood the instrument was quite as sensitive as the best of the usual patterns of telephone." That looks as if it had been used as an ear telephone. That reference to sensitivity might refer to its reception of a single tone.

RDQ. 103. I am correct in understanding, am I not, that the entire description in your Paper refers to the use of the telephone as a syntonic receiver in connection with a space telegraphy system which you had invented and described in the Paper?

A. That was the special object of the communication to the Institution of Electrical Engineers, but it was not the special object of my patent.

RDQ. 104. No, I am referring solely to the Paper before the Electrical Engineers?

A. That had most to do with what I call tone telegraphy, of course.

RDQ. 105. You refer to a demonstration in a theatre at Liverpool: I understand correctly, do I not, that this theatre was not a commercial theatre

(Deposition of Sir Oliver Lodge, F. R. S.)

but was the theatre of your Physics Laboratory?

A. It was not a commercial theatre at all; it was the physics theatre in Liverpool University. [265]

RDQ. 106. Mr. Drewe asked you questions in regard to the observations of Mr. Evershed and Mr. Sennett in the Discussion of your Paper and he asked you whether you thought, after reading these remarks in the Discussion, that you had made some demonstration. Have you any direct recollection as to there having been any demonstration of apparatus at the Lecture?

A. I don't remember, but I think Mr. Benjamin Davies would be a good man to ask about that.

RDQ. 107. Did I understand you that Mr. Robinson was your Lecture assistant who had the usual duty of setting up apparatus for you in connection with Lectures?

A. Yes.

RDQ. 108. Referring again to Fig. 7 in your Paper, I understand you, do I not, that the pins shown as supporting the sounding-board were intended to be fixed rigidly to the sounding-board as described in the Paper?

A. I am not quite clear about that, but I think it is pretty clear that they were attached—both to the sounding-board and to the magnet below.

RDQ. 109. And the moving coil was shown as cemented to the sounding-board which would mean that a circle of the sounding-board corresponding

(Deposition of Sir Oliver Lodge, F. R. S.)
to the circumference of the moving coil was made rigid?

A. Made rigid?

RDQ. 109a. Yes; was made rigid; was held in fixed positions so that there would be no vibration in the circle, corresponding to the circumference.

A. Oh, no, I should not say that, the moving coil is to throw the board into vibration, and must do it by its attachment.

RDQ. 110. Is it not true then that the only portion of the board which would be free to vibrate, would be that between the circle in which the moving coil is attached and the nodal circle in which the pins are attached, with possibly some vibration beyond [266] the pins?

A. Oh yes, the whole of the board would be thrown into vibration by means of the vibrating coil attached to it.

RDQ. 111. This device was, however, intended to vibrate particularly for one given note?

A. Well, I think so. Yes, I think so.

RDQ. 112. Early in your examination by Mr. Drewe you stated, I believe, that this device, Fig. 7, was intended as a syntonic receiver, and later, in your examination by Mr. Drewe, when he was enquiring with regard to your results at Liverpool, and as to whether a modern similar apparatus would be successful, as a loud speaker, I believe you said that that was so as demonstrated by the results obtained at Liverpool.

(Deposition of Sir Oliver Lodge, F. R. S.)

I am correct in remembering, am I not, that you did not demonstrate the Fig. 7 form of device at Liverpool and I therefore take it that you were referring to a different form of apparatus at Liverpool?

A. Well, I don't remember using Fig. 7 for loud speaking purposes for transmission of ordinary speech to an audience. I don't remember it. (Examination closed.)

SIR OLIVER LODGE

recalled as a witness on behalf of plaintiff.

Direct Examination by Mr. Dyer Smith:

Q. 113. Sir Oliver, I understand that you wish to make some modification in, or addition to your testimony previously given; is that correct?

A. Yes.

Q. 114. Do I understand correctly that your remembrance of events previously testified to has been changed somewhat by the receipt of a letter from your late assistant, Mr. Benjamin Davies?

A. Yes. I didn't at first realize that in this matter Benjamin Davies had been my active assistant. I thought it had been Mr. Robinson, but Benjamin Davies had the matter of magnetic telegraphy [267] in hand and when I realized that, I wrote to him asking what he remembered about the meeting of the Institution of Electrical Engineers and whether he took up apparatus for

(Deposition of Sir Oliver Lodge, F. R. S.)

me and whether he made a demonstration. He has reminded me that we took up several pieces of apparatus and that, incidentally, we made a demonstration of what is rather incidental to the main subject that I was then speaking of, namely, of a loud speaker into which he sang a song. That has stimulated my memory although I had forgotten the incident, but I now remember his going back into an inner room while the audience waited and then from the board on the table came the strains of "Auld Lang Syne." I may say I clearly remember that that demonstration was made. I expect there were other demonstrations, but that I think was the chief one that you want to know about. I imagine that a large board was used because it would be most suited for the purpose and it would probably be supported as Robinson has testified, by upright pillars from the table because it would be too large to support any other way, I think. I am sorry I didn't remember it last time. I replied last time that I didn't remember any demonstration being made and that is what I want to correct.

Q. 115. You have no further actual remembrance of your own relating to this matter, I take it, Sir Oliver?

A. Well, that implies that my memory before was not my own.

Q. 116. No, sir, I didn't mean to imply that. I meant to ask whether you have anything further to add, with the qualification that what we want

(Deposition of Sir Oliver Lodge, F. R. S.)

is, of course, actual remembrance and not a matter of inference from anything you heard from Mr. Davies.

A. Yes. Well, what I told you was stimulated by what I heard from Mr. Davis, but I regard it as resuscitated memory, which I think it legitimate.

Q. 117. Quite so. That is all then, I think. [268]

Cross-Examination by Mr. Basil Drewe:

XQ. 118. Sir Oliver, you have told us you now remember a demonstration being given of a loud speaking apparatus when you read your Paper to the Institute?

A. In 1898?

XQ. 119. In 1898. Can you say whether the apparatus was of the general type represented by Def's. Comm. Ex. 1?

A. The apparatus would certainly consist partly of a magnet like the one exhibited, with an annular space in which the coil hung. That was of the essence of the invention.

XQ. 120. In addition to the magnet and the moving coil of which you have spoken there must have been a sound-board attached thereto?

A. Yes; there was a sound-board.

XQ. 121: Do you recollect the approximate size of the sound-board used?

A. I should say it would be about a square yard (demonstrating) and I expect it was made of deal. (Examination closed.) [269]

EDWIN S. PRIDHAM.

Direct.

I have examined the Lodge instrument which is now marked in this case Plff's. Ex. 13. This instrument is a device made, according to Sir Oliver Lodge's testimony, to use in his lectures. It is marked with the Roman numeral II. It indicates that it was exactly like the other instruments that were used in his so-called demonstrations. I would like to call attention to the fact that there was no spacing means within this cylinder such as Magnavox uses. The coil is loose in here, and would not operate to space the poles apart at all. This cap here, as far as anyone can tell, never had a sound-box mounted on it. Those two holes are for a spanner wrench to unscrew the top pole piece. The movable coil was put into the annular gap and moved up and down in there and was attached to a large sounding-board which was supported upon these retort stands, and not connected in any way to the casing, whatsoever.

Mr. LOFTUS: Would such a device as you have just described be susceptible of commercial manufacture, or shipment, or of use in a home?

Mr. MILLER: I object to that question as irrelevant, incompetent, and immaterial. We are using Sir Oliver Lodge as an exponent of the prior art to show what the prior art is. It makes no difference whether it could be used in a house or a home for domestic purposes, or not.

The COURT: Objection overruled.

(Testimony of Edwin S. Pridham.)

Mr. MILLER: Note an exception.

A. It would not, for this reason: The instrument Sir Oliver Lodge made in London and demonstrated in his lectures was a demonstrating device to illustrate a moving coil in a magnetic field. It operated so that a speech could be heard throughout a room (a theater, as he called it. He used the word theater in the English sense, meaning a lecture-room, as he states later on [270] in his deposition.) This instrument was not commercial in any respect that Sir Oliver Lodge demonstrated there. It had absolutely no means of holding a diaphragm as an integral part of the instrument. You could not ship it any place. Nobody could handle it except an expert. Experts set it up for his laboratory demonstration, and he demonstrated it. The efficiency of the Lodge instrument would be very poor, for these reasons: It had a wide air gap; it had no means of holding pole pieces in correct spaced relation. The diaphragm was not mounted upon one of those poles. The coil was in no way related in position with the air gap by any mechanical means associated with the instrument. Consequently, it would be very inefficient. His air gap is exceedingly wide, three-eights of an inch, practically .375 of an inch, whereas in the modern instrument the air gap is .040 of an inch. It would take an enormous amount of wire for a magnetic field to get the same amount of density of magnetic lines in the air gap as is had with a very small

(Testimony of Edwin S. Pridham.)

quantity of wire in the present day instruments, or Magnavox. The efficiency of a dynamic speaker, as far as the magnetic structure is concerned, is figured in what we call watt pounds of wire; that is, you use so many pounds of wire and so many watts of current to produce a certain energizing force. With a very large magnetic field you either must use a great amount of copper, and if you have a wide air gap you must use a large amount of current. In Lodge's instrument, with an air gap that was practically 10 times as wide, or 9 times anyway, you necessarily, under the very smallest of conditions, would have to use 9 times as much power to energize that magnetic field as you would in the present day speakers with the same area of air gap. That would make the instrument very inefficient from a magnetic standpoint. [271]

In the Lodge device the only instrument which was illustrated as a loudspeaker consisted of a large sounding-board. This sounding-board was approximately four feet by four, as Sir Oliver Lodge testified. It was supported loosely upon tripods. There was not any periphery support to this diaphragm. It was supported in three places, three points. It acted as a sounding-board. It was very large. Some of his sounding-boards were made 3/8ths of an inch in thickness. We know by all rules of today that the efficiency of any speaker is determined by the weight of the vibrating system; the smaller the weight of the vibrating system the higher the efficiency. Dr. Lodge, in this instrument

(Testimony of Edwin S. Pridham.)

which he demonstrated to show the vibration of coils in magnetic fields, was not concerned with efficiency, at all; he simply wanted to set a large board in vibration. In the Magnavox instruments, the diaphragm is a light diaphragm; the coil is light; the diaphragm is a flexible diaphragm, corrugated for the very purpose of making it stiff in the center and flexible at the periphery. It is mounted completely around on the periphery in the rings which we term the soundbox of the instrument.

Q. The effect of that peripheral support is what in regard to acoustical results?

A. The effect of the peripheral support is exceedingly important in the reproduction of sounds. If the diaphragm is not supported continuously around on the periphery so that there is equal stress on the diaphragm throughout its support, we obtain what is known as blasting. Blasting is simply the unequal vibration of the material of the diaphragm, due to sound vibrations. This is shown very simply and easily in the laboratory with sand figures; if the diaphragm is not equally supported around the periphery, parts of the diaphragm are suddenly jumped into very violent vibration, higher than the rest of the [272] diaphragm. These sand figure patterns immediately spring out, and you can see what is the trouble and you can correct that trouble.

Q. You heard the defendants' expert, Mr. Fouts', use of the term "blasting" here the other

(Testimony of Edwin S. Pridham.)

day: Do you agree with his use of that term in the connection that he used it?

A. No, I do not. I think Mr. Fouts was most probably referring to resonance effects; that is, certain vibrations which are more powerfully produced than other vibrations due to the natural period of the diaphragm. Blasting has nothing to do with resonance effects. Blasting has to do with the unequal vibration of the diaphragm in different parts. It is very easily shown. Every laboratory for acoustical work is equipped with apparatus for showing the unequal vibrations of diaphragms.

Q. These resonance effects are in the nature of periodic vibrations?

A. They are periodic in a way, yes; they are recurrent. They are recurrent vibrations of parts of the diaphragm caused by a weakness in the diaphragm at that particular spot so it will vibrate stronger than the rest of the diaphragm. Consequently, if one part of the diaphragm is vibrating more rapidly or more strongly than any other part of the diaphragm, it immediately causes a mixture of the sounds. This mixture of the sound waves takes place within the diaphragm and causes this distortion of sound known as "blasting".

Q. The periodic vibrations or resonance effects occur just as often in the case of the large paper conical diaphragm as in the case of the smaller metallic diaphragm using a horn?

(Testimony of Edwin S. Pridham.)

A. I would say they do. That has nothing to do with the size of the material. Every material object that is supported in any manner whatsoever must have a natural frequency of vibration. We have heard a very great deal about free cones, or freely- [273] supported cones: There is nothing like that in the industry. Every cone has a support; it must have a support or it could not stay in space. That support, no matter what it is made of, has a certain resiliency. Defendants' speaker has a resilient spring mounting at the apex of the cone to hold the coil in the air gap. This resilient mounting, of course, gives a springy effect to the cone when it is vibrating. You may say that it does not amount to very much: It amounts to enough to give a very definite resonant frequency to the cone. That is one of the great troubles in making dynamic speakers; this natural frequency of vibration that is present in all speakers.

Now, there is another type of diaphragm which does not exhibit this to so large a degree in the useful range of broadcasting; that is the small diaphragm which is coupled with an exponential horn. The smaller the diaphragm the less the mass; consequently, the higher the natural period of that diaphragm. If this natural period is above 10,000 cycles, it does not affect the reproducing to any great extent. These smaller diaphragms with horns are now developed so they will produce frequencies from 16 cycles a second up to 10,000 cycles a second,

(Testimony of Edwin S. Pridham.)

with practically no distortion. The cone acts like a piston, just as the diaphragm acts like a piston; it pushes air out in front of it, it compresses the air in front; it does not act as a piston purely and simply. A piston is something that moves to a certain place and stays there; it does not come back. In any one of these speakers, if you push the diaphragm out a little it will come right back to its proper place. Diaphragms that have been very flexibly supported at the periphery have been known and used for many years. A large cone does not move bodily under all frequencies, any more than a small diaphragm will move bodily. [274] The higher frequencies vibrate the cone near the center; the lower frequencies will vibrate the cone practically as a whole. For the general broadcasting frequencies, the cone does not move as a unit. Johnsen Patent 1,075,786 shows no spacing means within the casing that he has. Another thing about the Johnsen patent is simply this: That that hemispherical coil that Johnsen uses in the only figure in which he showed a horn or a diaphragm for reproducing acoustical vibrations, that coil is wound with layers of wire and the magnetic elements are inserted between the layers. It states so very definitely in the specification. If there were iron elements inserted between the layers of the winding, it would be a magnetic speaker and not a dynamic speaker. The iron would be magnetized by these currents going through that coil and immediately would be pulled

(Testimony of Edwin S. Pridham.)

over with terrific force to close the air gap, like an ordinary magnetic armature would close an air gap.

Mr. LOFTUS: I offer in evidence the chart that the witness has referred to during his explanation of the prior art.

(The chart was marked "Plff's. Ex. 16.)

Q. In discussing sound-boxes in their various forms, as you did a while ago, can you refer to any authorities in support of your definition?

A. Yes. Besides the patents to Lumiere which have been admitted in this case, I believe I have before me a page taken from a book by Dayton C. Miller, of the Case School of Applied Sciences, at Cleveland. Dayton C. Miller is a recognized authority on acoustics, especially on musical sounds. He has written a book called "The Science of Musical Sounds." He goes into that quite thoroughly. This book was published in 1916. I have here a photostat of Page 155 of that book, which illustrates various types of diaphragm mountings. He says: [275]

> "In the early experiments it was thought desirable in order to protect the diaphragm from the indirect sounds to enclose it in a housing."

That is a diaphragm housing.

> "Various shapes and sizes of front and back coverings are shown in Fig. 121."

(Testimony of Edwin S. Pridham.)

These are the diaphragm mountings of various sound boxes. At the end of the upper row of figures, there will be shown a diaphragm housing with a ferrule extending the complete extent of the diaphragm. Others have smaller openings. At the extreme right, between the two rows, there is a mounting of a diaphragm which Miller calls a diaphragm housing. It simply shows two peripheral rings similar to the rings that Lumiere shows in his device. In the lower figure the fronts are all open. Various types of backs are used.

Now, in regard to this particular drawing I would like to call attention to the fact that conical diaphragms were well known in the art. One of the very earliest patents we have is the British patent to Siemens, in which he shows a conical diaphragm attached to a movable coil. The diaphragm is in a housing, a wooden box. I would like to call particular attention to that patent, because it is the earliest on record, the Siemens British patent. I am just going to show a conical diaphragm mounted in a housing, as Miller shows in his drawings. In Siemens, in Fig. 6, we have a conical diaphragm mounted in the wooden box. There is a movable coil attached to that diaphragm. Here is a wooden box here *with* Siemens calls simply a box for supporting a diaphragm. A conical diaphragm in any one of those sound-boxes would of course then be the perfect equivalent of a flat diaphragm. There is no question about that. Also

(Testimony of Edwin S. Pridham.)

there may be some doubt as to whether Dayton C. Miller referred to a sound-box in those things. [276] He calls it a housing. On Page 156 of Dayton C. Miller he describes the various types of horns which go on these various diaphragm housings. He states:

> "A horn as used with instruments for recording and reproducing sound is usually a conical or pyramidal tube, the smaller end of which is attached to the sound-box containing the diaphragm."

That occurs on Page 156 of Dayton C. Miller's article. On Page 157 of the same book are shown various types of horns with all sorts of apexes—large apexes and small apexes. These horns were supposed to go on these types.

Mr. LOFTUS: The photostat the witness has just referred to has heretofore been marked "Plff's. Ex. 7 for Identification." I would like to offer it at this time. Also to have the Dayton C. Miller book not offered in evidence, but merely marked for identification. I do not believe it is necessary to offer the entire book. We have a photostat of the pertinent page. The witness has read from other pages which go to explain his testimony.

The COURT: You are offering a photostat of Page 155?

Mr. LOFTUS: Yes, your Honor.

The COURT: That may be admitted in evidence.

(The document was marked "Plff's. Ex. 7" in evidence.)

(Testimony of Edwin S. Pridham.)

Mr. LOFTUS: I ask that the Dayton C. Miller book to which the witness referred be marked for identification.

The COURT: It may be marked.

(The document was marked "Plff's. Ex. 17 for identification.")

A. In the art of reproducing sounds, many various types of diaphragms and sound-boxes were used. Conical diaphragms, as I said a moment ago, were very old in the art. The patent to Dann and Lapp shows a conical diaphragm. The patent to Dann and Lapp is No. 338,660, patented March 23, 1886. It shows a conical [277] diaphragm in a ring peripherally supported, and mounted upon a flat board. The patent to Duwelius, No. 674,575, was issued in 1901. This shows a diaphragm mounted in a support or a housing in which the tubular opening or ferrule extends over the greater part of the area of the diaphragm. In this patent also are shown types of horns with large openings at their apex to fit upon this particular sound-box housing; Fig. 8 especially of this patent shows two horns, one on the front and one on the rear side of this soundbox housing, showing that there is no constriction whatsoever of the top plate in the so-called sound-box. There is a patent to Shanks showing a very large diaphragm supported in rings, which was used for a phonograph without a horn. This patent is No. 822,024, patented May 29, 1906. The patent to Lumiere, 986,477, pat-

(Testimony of Edwin S. Pridham.)

ented March 14, 1911, calls particular attention to one of the objects of his invention, being a sound-box. He states in line 27, page 1, as follows:

> "The invention also relates to the sound-box in which the diaphragm is mounted."

The next Lumiere patent to which I refer and in which the sound-box is used is Patent 1,036,529, patented August 20, 1912. In this he also refers to the object of his invention. He says in line 30, page 1:

> "My invention also relates to the sound-box in which the diaphragm is mounted."

In order to show that this term was not used as a misnomer, all through the claims of his patent the very thing he claimed was and he uses the term "sound-box." In Claim 2, for instance, he says:

> "In a sound-box the combination of a diaphragm and means to hold said elements in a flexed position."

In Claim 5 he says, "In a sound-box." Then further on, Claims 27, 28 and 29 all refer distinctly to this particular combination of a sound-box and other elements. [278]

In two patents to Lumiere the term "sound-box" is used to describe a flexible, quasi-conical diaphragm which is mounted in rigid rings which he accurately describes and numbers. In this particular patent he describes the sound-box as the

(Testimony of Edwin S. Pridham.)

mounting, and shows it clearly in the drawings and the numerals, attached to parts of the drawings. Lumiere was not an ordinary unskilled workman, or a man unacquainted with his language. He was a very famous scientist and physicist. He received many distinguished medals for his work. He knew what he was talking about. The Patent Office allowed him these patents when he used the term "sound-box."

I would also like to refer to a patent to Stroh, a British patent, No. 3393, issued in 1901. Fig. 1 shows a conical diaphragm mounted in a diaphragm housing. This particular conical housing that he shows has a peripheral ring of great flexibility, shown in Figs. 2 and 3 of this particular drawing. All these patents that I have been referring to relate to diaphragm housing or sound-boxes and conical diaphragms or quasi-conical diaphragms, such as Lumiere used.

The Johnson patent 1,180,401 is for a cup-shaped or cone-shaped diaphragm which is used in a diaphragm mounting. It has a flexible peripheral rim attached at the edge of the conical part. It is described very clearly in the specification as a disc of conical shape which will vibrate bodily as a whole with the flexible peripheral support. Reading from the specifications:

> "Generally stated, the form of this invention hereinafter described provides a flat, annular, vibratory flange, to which is secured a

(Testimony of Edwin S. Pridham.)

bulged or conical substantially inflexible major portion adapted to reciprocate as a whole within the engaged peripheral edge of said annular flange."

This patent was issued April 25, 1916. [279]

I think those are all the patents to which I care to refer which illustrate conical diaphragms, diaphragm housings, and sound-boxes.

Mr. LOFTUS: I offer in evidence the book of patents referred to by the witness in his answer as illustrating his explanation of the various forms of sound-boxes, diaphragms, etc., as follows:

Maxwell	216,051	June 3, 1879
Dann and Lapp	338,660	Mar. 23, 1886
Duwelius	674,575	May 21, 1901
Shanks	822,024	May 29, 1906
Lumiere	986,477	Mar. 14, 1911
Lumiere	1,036,529	Aug. 20, 1912
Johnson	1,180,401	Apr. 25, 1916
Stroh (British)	3,393	1901

(The document was marked "Plff's. Ex. 18.") [280]

Q. Will you point out, Mr. Pridham, wherein there are any similarities or dissimilarities as between the disclosure in the British patent to Siemens No. 4685 and the subject-matter set forth in Claim 8 of the first patent in suit?

(Testimony of Edwin S. Pridham.)

A. In the Siemens British patent there is shown in Fig. 6, and also in Fig. 5, a magnetic field, a vibrating conducting coil rigidly attached to a diaphragm, the coil disposed in the field. However, I fail to find any connections whatsoever to the movable coil which is represented by the letter A in this device. It shows no connections whatsoever leading from the coil to an operating circuit. There are many movable coils operating in a magnetic field in which the operating wire is led right off the coil to the operating circuit. However, in Claim 8 of the Magnavox patent No. 1,266,988 we have this particular combination. We have a moving coil—I will read the claim: "In a receiver for telephony, the combination of a soundbox and its diaphragm, of a magnetic field, a vibrating conducting coil for the telephonic currents disposed in said field, and rigidly secured to the diaphragm." Now, so far as Siemens shows that combination. Now, I read further: "and connections between said coil and the operating circuit comprising thin metallic strips secured to the diaphragm." Siemens does not show that element in this patent. Therefore, I take it that the Siemens patent does not read on the Magnavox patent, Claim 8.

Q. Have you made any charts illustrating the purpose and operation of the securing of these lead-out strips to the diaphragm, and if so, please refer to them in connection with your answer.

(Testimony of Edwin S. Pridham.)

A. I have made a chart. I sketched the idea in pencil and had the draftsman draw it up according to my direction. In the top figure is shown an illustrative drawing of the [281] Magnavox Claim 8. It shows a vibrating coil disposed to be vibrated in the magnetic field. It shows the fine wire of the movable coil attached to the diaphragm. It shows connections between the coil and operating circuit which are attached to the fine wire of the movable coil where these fine wires are attached to the diaphragm. The practicability of this scheme is that the fine wires flex with the diaphragm, and the flexible operating circuit wire is attached to these fine wires where those fine wires flex with the diaphragm, consequently avoiding breakage.

In the middle drawing is shown a diagram illustrating the method in which the operating circuit wires are brought out from the coil of the Stromberg-Carlson instrument. We see a coil vibrating in the magnetic field. This coil is wound with fine wire. The terminals of that fine wire are attached to the diaphragm. The operating circuit wires which we call connections between the coil and the operating circuit are attached at this point to these wires.

In the Atwater Kent drawing, or the drawing which illustrates the method in which Atwater Kent uses this idea, we have a vibrating conducting coil for telephone current disposed in the magnetic field.

(Testimony of Edwin S. Pridham.)

The fine wire of the coil is attached to the diaphragm, the connections between the coil and the operating circuit are attached to this fine wire at some point where the fine wire is attached to the diaphragm.

Mr. LOFTUS: Mr. Pridham at the time of the noon recess was discussing the subject-matter of Claim 8 of patent No. 1,266,988, and made various references to a chart. I now offer in evidence the chart.

(The chart was marked "Plf's. Ex. 19.") [282]

Q. Will you state concisely, Mr. Pridham, what, if any, new result over the prior art that has been referred to here was accomplished by either of the two patents in suit?

A. A very distinct new result was accomplished in producing a mechanical instrument in which the vibration of the movable coil could take place in the magnetic field with sufficient amplitude to create a very large amount of sound, so that the operating circuit to the coil would not be broken. That was the new result obtained under claim 8 of the first patent. The decidedly new result obtained by us from the invention as represented in the other patent was the development of a loud-speaker which was commercial in all its forms; it permitted a very great amplitude of movement of the movable coil; it permitted commercial operation and shipment of the instrument; it per-

(Testimony of Edwin S. Pridham.)

mitted the instrument to have great acoustical efficiency and mechanical efficiency. In fact, it was a successful instrument from the standpoint of commercial use. The fact that the pole pieces were held in spaced relation within the casing and a flat plate was used as one of the poles and the sound-box with its diaphragm was mounted on one of those poles to be in steady fixed relation with the concentric air gap gave us an instrument which had not been produced before, and it produced an entirely new result that had not been produced before.

Q. Prior to these inventions disclosed in your two patents, what, if anything, was commercially in use to your knowledge in the way of a telephone receiver or loudspeaker suitable for this purpose?

A. There were in use at the time we were working on these loudspeakers various types of magnetically-operated loudspeakers which consisted of a magnetically-operated armature [283] which was attracted to the poles which were part of a magnetic structure. The telephone current went through these energizing poles of the magnetic structure, and attracted the iron armature to the pole pieces. That was generally known as a magnetic type of armature. There were several of those on the market. I have seen a number of them in operation.

Q. Were they or were they not satisfactory?

(Testimony of Edwin S. Pridham.)

A. I think they were not satisfactory. That is my personal opinion as a person well versed in that art. They would reproduce sound. They were never used with any great commercial success that I know of. I saw installations in the White Sox Ball Park in Chicago. I saw installations of these particular instruments in the Morrison Hotel. They never did supply what I thought, and what a great many other people, I imagine, thought was a commercially successful loudspeaker.

Q. To what extent, if you know, are such magnetically-operated annunciators or loudspeakers used at the present time?

A. I would say from a percentage standpoint that they are practically obsolete. I do not believe there is one-tenth of one per cent. of the loudspeakers on the market today operated by a magnetic armature.

Q. Are you able to tell us the number of devices of the dynamic type manufactured under the two patents here in suit which have been made and sold by the Magnavox Company up to the present time, or say up to the first of the year?

A. Yes, I am. I have a résumé of the sales made which I would like to read. The total number of units sold up to the first of 1932 was 1,490,237 for a total amount or sum of $13,931,965.65.

These figures do not include devices made by our licensees. They are figures that were obtained from

(Testimony of Edwin S. Pridham.)

the books of The Magnavox [284] Company, of units made by The Magnavox Company. The Magnavox Company has sold loudspeakers of the dynamic type to defendant Stromberg-Carlson Company. They sold loudspeakers to the Stromberg-Carlson Company in the year 1928, to my personal knowledge. The type of loudspeaker so sold to Stromberg-Carlson Company was like the instrument in evidence in The Magnavox Co. v. Hart & Reno, marked Plff's. Ex. 5 in that case. (Said device was then offered in the present cause and marked Plff's. Ex. 20.) The drawing which you have shown me is a correct drawing of the Magnavox instrument which has just been offered in evidence as Plff's. Ex. 20. (Thereupon the said drawing was offered in evidence and the same was marked Plff's. Ex. 21.) I am familiar with the suit of The Magnavox Co. v. Frederick H. Thompson Co. The device in that suit was known as the "Majestic" device. I have a copy of a license entered into between The Magnavox Company and the Grigsby-Grunow Company, manufacturers of the Majestic device, which I present herewith. (The same was offered in evidence and objected to as immaterial, irrelevant and incompetent and not binding on the present defendants. Objection overruled and exception noted. The document was then marked Plff's. Ex. 22.) [285]

(Testimony of Edwin S. Pridham.)

Cross-Examination by Mr. Miller.

The first machine made according to the drawings and description of Patent 1,266,988 sold, was in 1916, to a "magician" called Alexander the Great. He used it in his act. It had the form of a coil shown in the drawings of this patent; that is, wedge shaped. It had the device marked "27" in the patent drawings. It was the same as Defs' Ex. A with the exception that the coil was wedge-shaped or comb-shaped and the identical kind of strips that were used on the diaphragms might not have been exactly the same. The connections between the coil and the operating circuit were substantially the same as shown in Exhibit A. The ends of the connections leading from the coil were attached to binding-posts. They were bent over before they got to the periphery.

We sold a great many instruments of that kind —I would not say a great many as figured according to our present production, or anything like that, but we sold a number of instruments from 1916 to 1918 embodying this wedge-shaped coil, and also embodying the operating circuit wires which were connected to the moving coil wire.

Q. You say in this patent, beginning at line 27, page 2:

"Thin metallic strips 27 are glued to the diaphragm with shellac or other suitable substance, and insulating material 28 in addition to the shellac may be laid between the metallic strips and the

(Testimony of Edwin S. Pridham.)

diaphragm. The said strips 27 are secured at their inner ends to the fasteners 24 on the diaphragm, and extend radially outward to the periphery of the diaphragm, where they are projected downwardly and attached to binding posts 29 secured to an insulating block 30 on the sound-box." I assume that is substantially the same construction that is shown in this model, [286] Defs'. Ex. A, that I have just shown you.

A. That is correct.

Q. You say those were the strips that were used to obviate the breaking of the former strips or the former connections that had been used.

A. That is correct.

Q. What were the other connections that you used and which you found would break?

A. The other connections which we used up to this time were the wires of the coil, itself. These wires of the coil, itself, were led out to binding posts, and then the operating wires were connected there.

Q. And you found in practice that they broke?

A. Yes, invariably they broke after a few hours' use.

Q. And you substituted for these round wires the devices shown in Fig. 9?

A. Yes, we substituted for the round wires of the movable coil the thin metallic strips which are shown in the patent.

Q. When you were referring in the specifica-

(Testimony of Edwin S. Pridham.)

tion to thin metallic strips, what devices were you referring to?

A. We were using practically any conductor that could be glued to the diaphragm.

Q. No, it does not say any conductor; it says "thin metallic strips." Those were the devices 27 in the drawing?

A. Yes.

Q. The expression "thin metallic strips" would be an apt designation of those devices 27, would they not?

A. Yes, they would. Do you wish me to tell you what we actually used in our instruments?

Q. No. I am asking you about this patent, and what you used in the machine sold to Alexander the Great.

A. In that particular machine I am quite sure we used the strips as shown in the exhibit that you just showed me. [287]

Q. After the sale of this machine, do you know who got the next one?

A. We sold quite a number to a company that was interested in religious propaganda here in San Francisco. I have forgotten what the man's name was. He had a truck and gave religious talks, talking into a transmitter, and the Magnavox instrument would reproduce his voice. He would give sermons to crowds.

Q. Out in the street?

A. Out in the street, yes.

(Testimony of Edwin S. Pridham.)

Q. Of the total number of machines that you sold, how many were constructed mechanically like the drawings shown in this patent and containing the strips 27 and the wedge-shaped coil?

A. Constructed mechanically like the drawings shown in the patent, and also containing these strips, I imagine we sold 200 altogether.

Q. Over what period of time did that extend?

A. That extended from 1916 to 1919.

Q. Did you make any change in 1919?

A. We did make a very great change in 1919.

Q. What change was that.

A. We changed from the comb-shaped coil to the cylindrical coil.

Q. What was the reason for that change?

A. The reason for that change was this: We found that in shipping these instruments which were constructed according to the first patent, the mechanical construction was such that the coil would not stay fixed, the air gap would not stay fixed. It was a horseshoe magnet and we had quite a bit of difficulty in the mechanical stability of the instruments. They would work perfectly in the laboratory and for demonstration. As a matter of fact, we sold about 200 of them altogether. They were not the mechanical type to stand up. They were the horse-shoe electromagnet type and we discontinued that type after making about 200 from 1916 to 1919. The instruments that followed had a cylindrical pot and a cylindrical core. [288]

(Testimony of Edwin S. Pridham.)

From 1916 up to 1919 we sold the form as mechanically shown in the drawings of Patent 1,266,-988. After that we manufactured and sold the form illustrated in the second patent in suit, No. 1,448,-279. It would be difficult for me to say exactly the first date that we sold this latter type, but it was some time in 1920. We have continued to sell this type of machine up to the present time. It it the electrodynamic type, as shown and described in the specifications of our second patent. We commenced to sell the type of machine in which we used the conical diaphragm and a dynamic drive, in the Fall of 1926. Up to that time (1926) the number of loudspeakers of the type shown in the second patent in suit sold by Magnavox Company was about 400,000. The remainder of the 1,400,000 machines mentioned by me would be of the type containing the conical diaphragm. From the time we commenced to sell the conical diaphragm type there were many loudspeakers on the market using conical diaphragms. As I recall it, Farrand put out a conical-type diaphragm. Magnavox itself put out a conical diaphragm speaker in 1924, but it was not of the electrodynamic type. The Radiola 104 came on the market, as I remember it, in the Summer of 1925. That was the first one I saw. I saw that at a demonstration given by Sherman, Clay & Company in Oakland. Others using conical diaphragm machines prior to the time or at the time

(Testimony of Edwin S. Pridham.)

when Magnavox Company began to put them on the market were the Rola Company—I believe the Stromberg-Carlson Company had a conical diaphragm loudspeaker on the market at that time. The Boco loudspeaker was a conical diaphragm loudspeaker put out in 1924 or before. There were maybe 20 or 30 different types of the conical diaphragm on the market before Radiola 104 came out. That was not before we put our conical type diaphragm out. We put out our conical-type diaphragm at about the same time as [289] these others. However, I wish to call your attention to the fact that the conical diaphragm type that we put out was a magnetically operated loudspeaker. We put that on the market until 1928. Then the tremendous desire for electrodynamic speakers made those magnetically operated cones obsolete. They are practically obsolete now.

As to what the apparatus shown in the various photographs produced by me consisted of, in the earlier experiments and demonstrations, it generally consisted of a microphone transmitter like we talk into on the ordinary telephone, only that it is able to stand much heavier currents, a storage battery, a transformer, and a loudspeaker.

The loudspeaker had to be at some little distance, maybe 25 or 30 feet, away from the orator, either above or at one side, so as to prevent reaction between the loudspeaker and the microphone. The microphone and the loudspeaker were connected by

(Testimony of Edwin S. Pridham.)

telephone wires. Plff's. Ex. 9, Picture No. 1, is of President Harding talking to a large crowd. He is talking into a microphone transmitter. The loud-speaker is probably above the canopy there above his head. He talked through the microphone and that passed the sounds over the telephone wires to the horn, and the sounds were emitted from the horn. In all those pictures that is the same procedure. The horn was about 22 inches in diameter (that is, the bell) and was about 5 feet long. That system of public announcing wherein a speaker could address large crowds of people was new. The general train announcing and hotel announcing, like paging, had been done to a certain small extent, as I outlined before. Public address work, wherein a speaker could talk to 25,000 or 30,000 people was new. It was the first time it had ever been done, when Magnavox achieved it. It [290] is rather difficult to do that; that was the problem we solved. Many times we connected four or five horns in multiple in order to cover large crowds.

I spoke of making some experiments at Napa; that was in 1911 and the instrument we used was a wire tightly stretched in a magnetic field. We used a sort of a frame of wood with a peripheral electro-magnet behind it. Between the top of the frame and the bottom there was stretched a copper wire, and to that wire at the center there was attached a match. At the end of the match there was attached a diaphragm. That instrument was connected by

(Testimony of Edwin S. Pridham.)

a circuit to a little out-house about 200 feet away, and Mr. Jensen went out to the out-house and spoke into the transmitter and I listened at this reproducer. The reproducer produced his voice very clearly. We used a microphone and the operation was substantially the same kind of an operation as is shown in the photographs where we used the microphones and horns. We performed innumerable experiments to try to build up this reproduction so it would be as successful as the ordinary telephone receiver. Our next step was to couple a number of these "strings", as we called them, together, and through a system of leverage connect them to one diaphragm, because the greater the length of the conductor in the magnetic field the greater the force acting on the diaphragm with a certain current. We made quite a number of these instruments. Then we made a coil instrument wherein these wires were all formed into a rectangular coil. We applied for a patent on that particular instrument in 1912. That instrument used the horseshoe electromagnet, sound box and diaphragm with ear tubes connected to it. That was used on the telephone line. That was the first patent, No. 1,051,113, January 21, 1913. We used many and [291] various types of diaphragms; some of mica; some of metal; some of fiber; any non-magnetic diaphragm was used. We did not make or sell any of the devices shown in this Patent 1,051,-113. We did not make or sell any machines under

(Testimony of Edwin S. Pridham.)

this next Patent No. 1,088,283, of February 24, 1914. It shows a rectangular coil which was mounted for oscillatory motion. It moved around a pivot like the ordinary ammeter winding of today. It did not move up and down like the present coil, but operated back and forth. It was pivoted at the center. It shows the pivot very clearly in the patent. We made perhaps 5 or 10 of these machines, but we did not sell any of them. They were merely for experimental purposes. I remember Patent 1,105,924 of August 4, 1914 very well. That patent was exceedingly important in the art. We used it to a very great extent in our work. The specification tells there about the necessity of eliminating the hum of the magnetic field due to the rectified or other impure direct current. We sold a very large number of machines of that type, but not at that time. I refer to the use of that in much later work on dynamic speakers. I mean we used some of the feature of this patent in our subsequent dynamic speakers. It had a moving coil, substantially the same as our present moving coil. It is an annular coil. There is an annular air gap. It is a narrow air gap. I notice in the drawings quite a clearance between the coil itself and the side of the device. In another drawing there are two air gaps, so that so far as the magnetic efficiency goes it was not very good for that. However, it was for a different purpose entirely.

Q. Was that because the gap was too wide?

(Testimony of Edwin S. Pridham.)

A. I imagine so, yes.

In this Fig. 3 there is quite a wide gap there; also in [292] Fig. 2. We were not attempting in that particular device to make a loud speaking telephone. That was a telephone receiver which was operated with ear tubes. We had to use an air gap and a coil within the gap, and I imagine that we understood at that time that the gap should be narrow in order to be efficient. I would say that for an efficient instrument it ought to be narrow; yes. I imagine we could see by looking at it right away that the gap was too wide. I imagine that any electrician, seeing a wide air gap and being acquainted with the situation, would know that he could make it narrower. It is easy enough to make the gap narrow; it is hard to keep it narrow.

The machines which we sold under these two patents prior to the time that we began the selling of the conical diaphragm type in 1926, were equipped with horns. The object of having a horn was simply to direct the sound out so that people could hear it. The tapering end of the horn was connected to a ferrule on the soundbox.

Q. The horn does something besides directing the sound, does it not?

A. The horn forms a cone of air, the apex of the cone of air resting on the diaphragm, and the diaphragm pushes the cone of air out through the horn. The large bell-shaped part of the horn acts like the base of a cone. Consequently, the dia-

(Testimony of Edwin S. Pridham.)

phragm can get more air into vibration in that manner than with just a small diaphragm.

Q. There is quite a difference in the operation of one of these machines with a horn and one without a horn, is there not, or rather, there would be?

A. Yes. If you take a small diaphragm and leave off the horn you get very little air into vibration.

Q. You would not get as much as you needed to produce your [293] result, would you?

A. No, not at all.

Q. The horn has some influence upon the tone quality does it not?

A. A correctly-designed horn should have no influence on the tone quality. It should neither add to nor detract from the sounds.

Q. Does not the horn add its own natural period effects to the sound?

A. It is very undesirable for it to do so. Some types of horns may add their natural frequency. For instance, if you have a long horn, like a tuba, and a compressional wave should go through that tube, you would get the natural frequency of the length of that horn.

Q. Do you often notice in the reproduction of phonographs that there is a kind of a tinpanny sound mixed with the music?

A. Not properly constructed phonographs. The old type phonographs used in 1910 might, but in 1915, or 1920, I would not say they had a tinpanny

(Testimony of Edwin S. Pridham.)

sound, because there was a different type of diaphragm used.

Q. Would you agree with this statement: "A horn used in connection with a diaphragm greatly increases the response but it also adds its own natural period effects, which are quite complex." Is that true?

A. Not wholly. I believe the first part is true, but the latter part I have not found to be true in my experience, for this reason, the horn can be made so that its natural frequency of vibration is below any period used in the reproduction. When they are constructed in that way the horn has absolutely no effect upon the sound reproducing effect to increase the volume of air set into vibration.

Q. Would you agree with this statement: "That when a horn is added to the diaphragm the response is greatly altered"?

A. Yes, I would agree to that [294]

Q. But you would not agree to the first statement I made, would you, that the horn adds its own natural period effects, which are quite complex?

A. No, I would not agree with that if the horn is correctly constructed. Of course, you can produce a horn which will do that, and which will be very complex.

Q. Now, will you please turn to page 158 of the book by Dayton C. Miller, which you referred to, and see if that statement is not taken from that book?

(Testimony of Edwin S. Pridham.)

A. Yes, it is taken from that book.

Q. I understand that a horn has vibrations of its own, and when you send sounds through that horn it stirs up those natural vibrations in the horn, as well as sending the vibrations through the horn: Is that not correct?

A. That is not correct, except for exceptional circumstances where the horn is badly constructed. A horn, to be a true transmitter of the sound produced in the diaphragm to the air outside does not have any natural frequency of its own within the audible range of reproduction.

Q. Don't you know that it was a fact in the phonographic art that they were very inferior sometimes in results because the horn set up its own vibrations, which mixed with the vibrations of the music passing through it, and adulterated the music so as to give an inefficient reproduction?

A. No, that is not true, for this reason: Many horns were constructed at that time which were made very heavy; they were made out of wood an inch thick; we ourselves made horns of very heavy wood, an inch and a quarter or two inches thick; in those horns the sound was simply propelled through that horn as a conduit. It formed a cone of air. The apex of that cone of air rested upon the diaphragm. The horn acted as a conduit for that cone of air. The diaphragm simply vibrated that air up and down. [295]

Q. Would the horn act in any other capacity than as a pure conduit?

(Testimony of Edwin S. Pridham.)

A. If the horn were illy constructed, of thin material, and you had this column of vibrated air inside, the walls of the horn might act as a diaphragm and mess up the sound, as we say.

Q. Take the ordinary tin horn in the phonograph as used for years, and as used now, wouldn't they set up vibrations of their own?

A. Undoubtedly. They were very bad horns, those early tin horns.

Q. Didn't all the tin horns used at that time have that same effect?

A. No, I don't believe so.

Q. Didn't the Edison tin horns have that effect?

A. I would say this, as I have said before, that if the horn is badly constructed, of thin tin, so that the pressure inside the horn can distort the walls of the horn, that is true.

Q. I am taking a horn as properly constructed, and as Mr. Edison used to construct them, and as the Victor Company used to construct them.

A. They were very well constructed horns, the Edison horns and the Victor horns.

Q. Was not the defect I have suggested to you present in those horns?

A. I don't believe so, not in the horn.

Q. Did you ever listen to one of those devices when you could detect some other sound than the music, itself, to wit, the vibration caused by the tin of the horn?

A. Those horns were not always made of tin.

(Testimony of Edwin S. Pridham.)

Q. I know that. You can make them of anything you please. I am speaking now of the tin horns such as were made by Edison, and the Victor.

A. I don't recall tin horns made by the Victor. I recall the heavy wooden bell—yes, I do recall it, I beg your pardon, Mr. Miller. [296]

Q. There were many millions of them made and sold by the Victor Machine Company?

A. Yes, I recall now what you mean. You are speaking about the old type Victor horn that was exposed.

Q. They were known as the flower horns, weren't they?

A. The flower horn was an independent horn. The Victor Company did not use the flower horn. I will admit that they were horns that were made of tin and wood, and every other substance, yes.

Q. They sold probably fifty or one hundred million of them during their day.

A. That might be so.

Q. Will you please turn to page 70 of Dayton C. Miller's book and see if you don't find this definition of a diaphragm. You can follow me as I read it: "A diaphragm is a thin sheet or plate of elastic material, usually circular in shape, and supported more or less firmly at the circumference; the telephone is a diaphragm of sheet iron." You find that there do you?

A. Yes.

Q. You would not dispute that, at all, would you?

(Testimony of Edwin S. Pridham.)

A. Not at all; that is perfectly correct.

I spoke of going to New York for the purpose of exploiting our inventions. I made two trips there. The first one was in 1912, in the Summer. We made a trip to the Telephone Company with the instrument shown in the first patent in this bundle and spent a couple of months there. We were in the laboratory a couple of months, Mr. Jensen and myself, and we explained the device fully to them and came back to California. They did not adopt it. The advice of the telephone engineers back there was that we come back to the laboratory and try to develop this instrument further. They considered that the instrument was not a commercial instrument. This instrument that we had at that time weighed about 80 pounds and we listened [297] to it through ear tubes. It delivered very fine articulate speech. Through this instrument we talked over their circuits and demonstrated it for their engineers with great success. This instrument was not a commercial instrument, in their opinion. That was illustrated by the first patent that we took out. It is No. 1,051,113. It was simply a rectangular coil disposed in a magnetic field. It had a soundbox to which ear tubes were attached. We improved that further, as I just explained to you, in the patents that we took out; the succeeding patents.

Regarding the Lumiere device, Exhibit 11, I would say that that, if correctly made with all the elements as they are there, would be a very efficient

(Testimony of Edwin S. Pridham.)

device. This one is not correctly made. It has a very inefficient magnetic field. If you will notice how the magnetic field there is made you will see there are three poles with very small coils of wire on them. Under any circumstances that magnetic field will be very weak. It will not be an intense magnetic field in the air gap; so that I would say that as far as the diaphragm is concerned, and the movable coil with its housing, if that coil be immersed in a proper magnetic field it would be very efficient. I have played that identical instrument there, and was very much surprised to hear it play as well as it did, with the crude construction. Of that particular type there were not many sold. I might say the Victor Talking Machine Company sold a magnetic loudspeaker with that type of diaphragm. I believe that they sold 40,000 or 50,000 of them. This machine was bought in Los Angeles from a concern named the Penco Company. I think our Los Angeles distributor bought it and sent it up to the laboratory. It was advertised in the journals and in the technical papers at [298] that time. That was in 1928. It is not on sale now. I imagine it was discontinued very shortly after it was brought out, because it was so very inefficient from a magnetic-field standpoint, that the other loudspeakers that were on the market at that time, like the Magnavox, superseded it. It is an electrodynamic machine.

Q. I refer you to Defs'. Ex. D. United States patent to Siemens, and ask you if you do not find

(Testimony of Edwin S. Pridham.)

this language therein, in the second paragraph, on page 1: "When a permanent magnet, or an electro-magnet, is so constructed that it has its two polar surfaces of considerable superficial area presented to one another with a very narrow intervening space, the magnet exercises little magnetic influence on surrounding objects, being almost in the condition of a closed magnet. On introducing, however, a portion of an electric circuit into the narrow space between the polar surfaces of the magnet, and moving it to and fro, electrical currents are set up in the circuit, or, conversely, when electrical currents are sent through the circuit it is caused to move." You notice the expression there, "a very narrow intervening space," do you?

A. I do. This is a very interesting patent.

Q. He recognized the necessity for a very narrow air gap, did he?

A. Yes, he did.

Q. And he did show an air gap in his drawings, did he not?

A. Yes.

Q. Did he specify in his specifications how narrow that gap was?

A. He says a very narrow air gap is to be desired. I don't know whether he specifies the way it is to be made in his specifications.

Q. I have looked all through his specifications; he does [299] not anywhere specify how wide that gap is to be; he does say it is desirable to use a narrow air gap.

(Testimony of Edwin S. Pridham.)

A. That is correct.

Q. In fact, he has a claim for the air gap, claim No. 1, reading as follows: "A permanent magnet, having one of its poles extended and surrounding the other pole, an intervening space being left between the poles, substantially as set forth." That seems to be a claim for the air gap without regard to how wide or how narrow it is?

A. That is correct.

Q. There is another patent here on the subject of narrow air gaps which I would like to show you. That is Defs'. Exhibit P, the patent to Pollak. In this patent, beginning at line 22 on page 1, it is said: "The air space for the two coils is preferably provided by the use of a magnet shell which is separable from the core of the magnet, and by having at both ends of the magnet core a narrow space for the coils." And then further down he says, four lines from the bottom, on that same page of the patent, as follows: "A narrow annular intermediate space being left on each end between the core 7 and the edge of the side opening." And then in Claim 1 he gives one of the elements, among others, as a narrow air space, a coil in each of said air spaces, etc. Then in Claim 2 he also uses the same expression, narrow air spaces between the core and the end plate. You notice that he does not say anywhere in the specification how wide or how narrow that gap is, but simply refers to it as a

(Testimony of Edwin S. Pridham.)

narrow space. You note that in these patents, do you not?

A. That is correct.

Q. He evidently appreciated the necessity of a narrow gap, did he not, by using the word "narrow"?

A. I am not so sure about that in Pollak's patent, for this reason: Although he states narrow air gaps throughout his specifications, he uses two [300] air gaps in series or in multiple. His second claim calls for these narrow air spaces. We know that if you use these two air gaps around the central coil of a magnet it will not be as efficient as if there were one narrow air gap. However, I will say this, that undoubtedly Mr. Pollak appreciated the use of a narrow air gap. He was an engineer for the French Telephone Company, and undoubtedly was very well versed in the art. However, he does not show the equivalent of a narrow air gap in his patent.

Q. According to these drawings, how narrow is the air gap?

A. That air gap must be at least one-eighth of an inch wide. In this very small drawing I should judge by my eye that that air gap is one-eighth of an inch wide; that is .125 of an inch.

Q. When you said he had two air gaps, you meant he had one at the top and one at the bottom?

A. Yes, with one magnetic coil. I would like to

(Testimony of Edwin S. Pridham.)

suggest to you, Mr. Miller, that there is no contention about narrow air gaps per se.

Q. I show you another patent to Pollak, being the French patent 393,241, issued in 1908, in which he does not show the double air gaps but only one set of air gaps at the top.

A. That is correct.

Q. So that what you said in reference to the patent that had the double air gaps, one at the top and one at the bottom as being disadvantageous, or something of that kind, does not apply to this Pollak patent, because it has only the air gaps at the top.

A. That is correct.

Mr. MILLER: I would like to offer this patent in evidence as illustrative of the testimony of the witness, together with the translation.

The WITNESS: I would like to call attention in regard to [301] this French patent—— In this French patent to Pollak it will be noted that the air gap at the top of the magnet is considerably wider than in the United States Patent; how much wider it is impossible for me to say.

(The document was here marked "Defs'. Ex. II.")

Q. In your patents you have a narrow air gap in both of them?

A. Yes, we are supposed to have a narrow air gap in both of them.

(Testimony of Edwin S. Pridham.)

Q. Does your drawing show how narrow or how wide the gap is?

A. I would say it indicates a narrow air gap, especially that——

Q. Does your specification describe how wide or how narrow that air gap shall be?

A. It does not. It does not give the dimensions, as to how wide it should be.

Q. You thought that was quite an important matter, did you not?

A. Yes.

Q. Why didn't you describe the narrow air gap in it?

A. We were not interested in obtaining a narrow air gap. Narrow air gaps are well known in the art.

Q. Narrow air gaps were very old, weren't they?

A. Yes, indeed.

Q. You referred to the air gap in Sir Oliver Lodge's British patent as being too wide for practical purposes. Would an electrician, in looking at that drawing, recognize at a glance that the air gap was too wide?

A. I should think he would, yes, immediately.

Q. You did, did you not?

A. I did.

Q. As soon as you looked at it you saw it was too wide?

A. Yes.

(Testimony of Edwin S. Pridham.)

Q. Another electrical expert looking at it who saw immediately it was too wide, and he was versed in electricity, [302] etc., he would know how to make it narrower, would he not?

A. In that device you must remember that Sir Oliver Lodge was trying to make a coil vibrate in that air gap. The coil was in no way fastened to the top plate. It could move all around. For that reason, I think Sir Oliver Lodge was constrained to use a wide air gap very much to the loss of efficiency in his instrument. I think most probably that is why Sir Oliver Lodge used it. Undoubtedly Sir Oliver Lodge knew—he was a very eminent engineer, and he knew it was always advisable in a magnetic structure of this kind to get a magnetic field to use a narrow air gap.

Q. I will ask to have my question read, because you have not answered yet. I will put it this way. An electrician skilled in the art, looking at Sir Oliver Lodge's drawing for the first time, would not only recognize that the gap was too wide but he would know how, electrically, to make it narrower, or as narrow as he wanted it, would he not?

A. Answering your question directly as far as the magnetic field is concerned, the air gap in the magnetic field, he would know how to make that air gap narrower.

Q. He would simply bring the pole pieces closer together, would he not?

A. It is a very simple matter.

Q. No particular difficulty in that, is there?

(Testimony of Edwin S. Pridham.)

A. Not at all. Plf's Ex. 20 is a device that was manufactured in 1928 by the Magnavox Company and sold to the trade by the thousands. This specimen was sent to Mr. Loftus by the Magnavox Company. I tested out thousands of instruments of exactly similar construction.

Q. For some purpose or other you referred to your patent 1,329,928, dated February 3, 1920, and called attention to Fig. 10; what was the point you made there?

A. The purpose of calling attention to Fig. 10 was to show an example of bringing out the operating wire from the movable coil where the operating wire was not cemented to the diaphragm. The instrument as [303] illustrated in Fig. 10 was practically identical in every respect with the instrument illustrated in our patent disclosed in 1,266,988, in which the lead-out strips are claimed. I simply wanted to put this in as an example of how the lead-out strips were often attached to the coil.

Q. What is the form of that connection shown in Fig. 10 between the voice coil and the operating circuit?

A. That was evidently tinsel wire, telephone cord wire, of which we use many thousands of feet for this purpose. It consists of a small round tinsel wire. This tinsel wire is made up of maybe 60 or 70 fine strands of a very fine copper interspersed with thread.

Q. I believe there is no description of that in the specifications.

(Testimony of Edwin S. Pridham.)

A. No, there is not.

Q. Nor is it designated by any particular figure or letter in the drawings?

A. No, we did not claim it in this patent, at all, it was simply for the purpose of illustration.

Mr. MILLER: I desire to put this patent in evidence in connection with his testimony, because it was not put in evidence when he showed it to the court.

(The document was marked "Def's. Ex. JJ.")

Q. In the Atwater Kent and Stromberg-Carlson devices, what is the form of the conductor leading from the voice coil to the operating circuit?

A. In the Atwater Kent loudspeaker it is a form of tinsel wire, a flexible wire. This wire or conductor is formed of a large number of intertwined fine copper wires. I believe that practically the same thing is used in the Stromberg-Carlson.

Q. Is that what you referred to as tinsel wire?

A. That is correct.

Q. And the use of that was very old in the telephone art, [304] was it?

A. Yes, very old. Wherever you have a cord that has to move a great deal, like the cord to your telephone receiver, that cord is generally made of tinsel wire, in order that it will not break.

Mr. MILLER: That is all.

(Testimony of Edwin S. Pridham.)

Redirect Examination:

Mr. LOFTUS: Q. You were asked about narrow air gaps, and whether or not there was any problem in forming such narrow air gaps. Will you state whether or not there was any problem in connection with the actual use and maintenance of that narrow air gap, and, if so, what?

A. To all electrical engineers, the formation of a narrow air gap was always very desirable because we know the magnetic intensity increases in a magnetic circuit when the air gap is cut down. That is very old in the art, and it is very essential to have a narrow air gap. However, if you do have a narrow air gap you are immediately confronted with a serious problem, because there is a very intense magnetic attraction between the poles of the air gap, especially in an electrodynamic receiver where you have from 10,000 to 20,000 lines per square centimeter, and this attraction is very, very great. The slightest tendency of the poles to get off center will immediately shift that pole over and it will contact with the air gap to close the circuit. In general, the more narrow the air gap the more dangerous the situation becomes as to keeping that air gap in its true form.

Q. With regard to arranging the movable coil in that gap, does that present any problem?

A. That presents a very difficult problem indeed. It is not only necessary to space the two poles apart to form a very narrow concentric air gap, but it is

(Testimony of Edwin S. Pridham.)

very necessary to so arrange that coil in the air gap [305] that it may vibrate up and down, an axial motion, the vibration of a quarter to half an inch, whereas the distance between the pole faces and the coil may be only .002 or .003 of an inch. That is a very serious problem, and it is a problem that Magnavox conquered by mounting the diaphragm with its coil on one of the space poles, the other being of course spaced from the first one, and the diaphragm with its attendant coil mounted on the first pole; consequently, the coil was rigidly positioned in respect to this concentric air gap.

Q. And in your opinion are those problems which readily could be solved by the ordinary electrician or mechanic?

A. They are by no means easy problems to solve. It took us, you might say, from 1911 to 1920 to solve those problems, with a very urgent desire to solve them and a very urgent need to solve them.

Mr. LOFTUS: That is all.

Recross Examination:

As to how the voice coil is maintained in the center of the air gap in our Patent 1,448,279, after it is once fixed in relation to the top plate and the top plate is correctly positioned with relation to the center pole, then the coil will automatically be in proper relation to the air gap.

Q. But in case it got out of relation, how would you get it back? What do you have to maintain it in that position?

(Testimony of Edwin S. Pridham.)

A. It is maintained in position—I will not say it is maintained in position, it is originally placed in position by means of the screws shown in the sound-box. The screws go up through the top of the plate; they are fixed to the top plate through a free hole, so that the sound-box can be shifted around to locate the coil in the annular air gap with great precision. [306]

Q. Now, look at Fig. 4 of that patent, where you have an annular space or air gap with the coil in it, don't you know from looking at it that that seems to be quite a wide gap; in other words, there is a great clearance between the coil and the side of the pole piece?

A. I would not say it is a narrow air gap; it is not a wide air gap.

It would be very easy to maintain the coil in position by mounting the sound-box upon the top plate of this service. You will notice that the sound-box is mounted upon an extension of the pole 5; that is a ring there. In the actual making of this instrument, which is a permanent magnet instrument, you are looking at the end view of a permanent magnet instrument where, by all means, the air gap should be narrow. You do it by mounting the sound-box upon the top plate or outer pole and simply adjusting the sound-box on the top plate.

Q. How is the coil maintained in its central position in the gap in the Atwater Kent machine?

A. The coil is maintained in the gap in the At-

(Testimony of Edwin S. Pridham.)

water Kent machine by a resilient spider at the apex of the cone. After the air gap is fixed by the spacing ring on the plate of the Atwater Kent, the coil is disposed in that air gap loosely; then I think some gage must be put in there from the under side and the central spider is then tightened up. The spider is sometimes called a labyrinth spring. The coil is attached to it in order to keep it firm and steady in the center of the air gap. It is the same in the Stromberg Carlson, except the shape of the spider is a little different.

Mr. MILLER: I omitted a drawing of the Johnson patent which is shown in the little blue book of ours, and which was made by our witness. I have the drawing here now and some photostatic copies of it. While it is a little out of order, I would like to put it in evidence at this time if I may. I really forgot it before.

Mr. LOFTUS: There is this objection, that no such drawing [307] appears in the Johnson patent.

The COURT: I understand that.

Mr. MILLER: Yes, he took it from two figures.

(The document was here marked Def's. Ex. KK.) [308]

Redirect Examination

By Mr. LOFTUS: In this connection the demonstration that I want to offer here has to do with an inquiry made by the Court during the examination of the defendants' witness, Mr. Fouts, where

(Testimony of Edwin S. Pridham.)

the Court asked: "Suppose that sound box chamber in the Pridham and Jensen patent was enlarged to correspond to what is now called the cone-shaped loudspeaker, would it produce sound without a horn? A. I would not say it would not produce any sound at all; I think you would hear, probably a little mouse-like squeak from it. That is about all you would hear. It would not be of any satisfaction as a reproducer of sound without the horn." Now, Mr. Pridham, you heard that testimony?

A. Yes, I did.

Q. What have you to state in that connection, and are you prepared to make any demonstration? I also refer to another inquiry by the Court of Mr. Fouts wherein it was stated by way of question, "Enlarge every element in it, if you please; enlarge every element in it until it becomes a device as large as any one of the cone-shaped loudspeakers here in evidence, leaving off the horn, then would the device produce sound? It would produce sound. I think it would produce sound, yes. It would be a distorted sound." Now repeating the same question, are you prepared to demonstrate that and what have you to say in connection with these opinions of Mr. Fouts?

A. In my experience in making dynamic speakers from 1916 on to the present date, we have used all manner and types of diaphragms, small diaphragms and large diaphragms; sometimes the

(Testimony of Edwin S. Pridham.)

diaphragm and sound box would be used with a horn and sometimes they would not be used with a horn. We have sold many hundreds of instruments called telephonographs——

Q. Telemegaphone?

A. The reproducing part of the telephonograph was called the telemegaphone; the telemegaphone [309] was simply a dynamic speaker like we have up here with a small diaphragm. That was set in a cabinet and with a microphone reproducer which played phonograph records and would amplify during its reproducing. The cabinet was a large structure and you could use a horn in it or not, as you saw fit. I have in the past week reviewed a great many of my early structures, and I would like to demonstrate to the Court how these various diaphragms work. It will take me about two or three minutes to do this, but I think it will do a great deal to throw light upon this particular diaphragm.

Q. Will you please do that, and explain before you make the demonstration what sort of apparatus you have here so that it will appear in the record?

A. Yes, I will. I have a two-stage amplifier which my twelve-year-old boy made up for his radio set. It takes simply the input of a phonograph and leads it to the amplifier in the first stage and leads it to the second stage where it is amplified again and passes through this output connection to this telemegaphone. This telemegaphone, which is identical with the R-3, except for this fact,

(Testimony of Edwin S. Pridham.)

that this particular one was used in reproducing phonograph music, whereas the R-3 had a special induction coil which fitted it to receive radio impulses. I will put one on and I will play a record. This was sold just as is, like that, and it was also sold in a cabinet called a telephonograph. This cabinet had a square surface of maybe two square feet. Now I would like to play this for you. You will notice the difference between the loudspeaker without the baffle and with the baffle. I will play one more record.

Q. Remove the top of that sound box, Mr. Pridham.

A. Yes.

Q. For the record, you have been able to produce so-called self-sustaining sound waves on this demonstration without a horn, first?

A. Absolutely, the music would compare very favorably [310] with anything produced in the radio field from 1922 on to 1926.

Q. Do you find any mouse-like squeaks in it?

A. No, I do not. I have found in the demonstration of radios, it is a matter of degree of quality, and it would be very acceptable in a great many places. In fact we sold instruments that did not produce anywhere near as good a quality as that, we sold two or three hundred thousand of them.

Q. When you placed that board there, how did that compare with the effect of a horn?

(Testimony of Edwin S. Pridham.)

A. The board placed upon there is similar to placing the instrument in a cabinet. All loudspeakers today are either placed on a board or in a cabinet. If you take them out of the cabinet to play, they lose the fundamental characteristics; the lower notes which emanate from the sound box in the front are neutralized by the pressure of the back part of the diaphragm; in order to stop the neutralization we either put these in the cabinet to shut off the front board of the sound box from the rear, or you can use a flat board. In practically all radio cabinets designed today they simply put the loudspeaker in a cabinet and that serves very well as a baffle. Now "baffle" is simply a term that was coined, you might say; it has been used for many, many things. In fact, in one of the very early patents of Dann and Lapp a baffle was shown. The theoretical effects of a baffle were investigated by Lord Railey about 1895, and it is a well known physical thing.

Q. You understood the equivalency of the horn and baffle at the time that you applied for your patent?

A. I did, it was well known in the physical art and you could either use a horn or baffle.

The COURT: You say the word "baffle" has been coined. You find the word "baffle" in the dictionary.

A. Oh, yes. In [311] explaining my meaning as to the word "coined," I meant it was coined for

(Testimony of Edwin S. Pridham.)

this particular art. Baffle is something that stops or opposes, in the dictionary, and of course this board, being a stopper or an opposer of the sound waves, they naturally termed it a baffle. I do not mean it was coined like the word "kodak" or anything like that, but it was fit for this particular problem.

Mr. LOFTUS: You have constructed an enlarged diaphragm and sound box, have you?

A. Yes.

Q. Are you prepared to demonstrate that?

A. I would like to demonstrate that and show the effect of simply multiplying the size of this diaphragm and sound box.

Q. Explain as you go along, the construction of that, and in what manner it compares with the disclosure of the patent in suit.

A. When the discussion came up about the size of diaphragms, I immediately got in touch with our laboratory in Chicago and they made up this flat diaphragm very similar to the metal diaphragm that we use. It is enlarged three to one. It is not an absolutely micrometric enlargement, but approximately three to one. This diaphragm and sound box is made identically the same, with the tripod or the support for the coil. Here is the diaphragm. Now with this sound box on here, which is very crudely made—we did not wish to go into the cost of making dies to make a metal sound box, so this is a good heavy ply wood. It

(Testimony of Edwin S. Pridham.)

will not vibrate of itself and could not possibly give off any sound. When that is put on there in this manner we have a magnified Magnavox sound box of the 1922 pattern. Now I would like to demonstrate the sound box which is exactly the same except for the enlargement. I will play with the top of the sound box on and with the top of the sound box off, and let you hear how it sounds. You can feel the diaphragm vibrate all over the surface. [312]

Now I would like to play one more record to show how the diaphragm in the enlarged form reproduces every portion of the musical scale from the lowest bass to the highest treble. That bass note there is the tuba. You will notice that it makes the diaphragm move over its whole surface as a unit. Now putting on the top of the sound box you will notice it has the effect of a small baffle.

Q. How does that reproduction compare with the cone type diaphragm which Mr. Fouts referred to as a free-moving cone?

A. I would say that with the same degree of care used in a flat diaphragm as is used in making a cone diaphragm for a commercial product, you would get exactly the same acoustical result. The problem is simply to get a light structure which vibrates the air in such a fashion that the whole surface of the diaphragm will vibrate practically as a unit, for this reason, if the center of the diaphragm vibrates a little faster than the outside

(Testimony of Edwin S. Pridham.)

edges of the diaphragm, the phase relations between the sound are out of harmony, the inside pushes the air a little faster than the outside, and you get the effect of a very small baffle; the tones are practically neutralized. So consequently in building a diaphragm of that flat type it is necessary to get strength on that flat diaphragm. Now in contradistinction to the cone diaphragm the flat diaphragm must necessarily be built up a little stronger in the center, and as it comes out toward the edge it can become lighter.

Q. As in the case of Lumiere?

A. That in the case of Lumiere, or Stroh or Brown or any of those men who made these diaphragms, they made the diaphragm rigid at the center and progressively thinner at the edge, especially in S. G. Brown, who happened to be a very distinguished English scientist, his diaphragm [313] calls for a very thin aluminum diaphragm which is progressively thinner toward the edge until it gets to about .002 of an inch thick at the edge. The Magnavox Company itself built conical diaphragms as early as 1917, wherein they used a flat diaphragm that was .011 of an inch thick at the center and .002 of an inch thick at the edge. These diaphragms also produced very good music. Now I am willing from my acoustical experience to say that a flat diaphragm ten inches in diameter could be made and will be a commercial success on the market today.

(Testimony of Edwin S. Pridham.)

Q. With or without a horn?

A. With or without a horn. Now I have also used these large diaphragms with a large horn; in fact we built a large horn which had an area of opening of about 144 square feet; it was a very large horn. It was so large that people could dance inside of the mouth of it. It was built for Idora Park.

Q. You sold this type of instrument that you have just demonstrated in a cabinet so that you had this baffle board effect?

A. Absolutely, we sold many hundreds of them.

Mr. LOFTUS: We offer in evidence in connection with the witness' demonstration, certain parts of the apparatus that can be referred to, and I will have a drawing of that to make it understandable in the record. The first offer will be of the magnetic structure, which, by the way, is similar to Defendant's Exhibit A.

(The magnetic structure is marked Plaintiff's Exhibit 23.)

I will next offer the enlarged corrugated diaphragm.

(The corrugated diaphragm is marked Plaintiff's Exhibit 24.)

I will next offer the enlarged top portion of the sound box.

(The enlarged top portion of the sound box was marked Plaintiff's Exhibit 25.)

(Testimony of Edwin S. Pridham.)

Q. Now there has been some mention here of an article by [314] Rice & Kellogg, offered in evidence by defendant as defendants' Exhibit CC. Do you know who Rice and Kellogg are?

A. I know them very well. I have been at the General Electric Laboratories and have seen their work and read their articles. They are acoustical engineers for the General Electric Company.

Q. Prior to the appearance of this article had you sold them loudspeakers of the Magnavox type?

A. We sold a very large number of Magnavox speakers to the General Electric for use in commercial work and also for use in their laboratory.

Q. Do you know of any controversy that is going on between the General Electric Company and competitors in regard to the superiority of a cone as distinguished from a horn?

A. I am very well acquainted with that controversy, and it is purely a controversy regarding the efficiency of a cone or a horn. The General Electric engineers have always contended that a cone was superior to a horn. The Western Electric engineers have always said that a horn type loud speaker was superior. As a matter of fact this controversy has been going on for some time and the general opinion among acoustical engineers today, practically throughout the world is that a horn type of loudspeaker when properly constructed is by far the most efficient type of speaker there is in the world.

(Testimony of Edwin S. Pridham.)

Q. The Magnavox Company has remained neutral on that discussion, I assume?

A. Yes, we have remained neutral.

Mr. LOFTUS: That is all.

Recross-Examination by Mr. Miller:

This particular type of apparatus here is what is known as the 2-stage audio frequency amplifier. It receives weak impulses from any source, such as a phonographic pick-up as is used here. That weak impulse is impressed upon the grid of the first tube. [315] It is amplified through an amplifier circuit and results in a greatly enlarged output of the corresponding input. These happen to be Radio Corporation tubes. They are similar in principle to the DeForrest tube. This device marked "S.M. 220" is a transformer. It is the input transformer. It takes the electrical current from the electrical pick-up, passes it through the primary of this transformer, and the secondary of this transformer feeds the grid of the first tube. The transformer marked "S.M. 256" is the intermediate transformer and it is placed between the output of the first tube and the input of the second tube. It simply takes the amplified output of the first tube, passes it through the primary of this transformer, and the secondary of this transformer feeds the grid of the second tube. The switch that you see next to the transformer 256 is the A battery switch. This simply disconnects the storage battery current from the

(Testimony of Edwin S. Pridham.)

tube. The storage battery current feeds the filament of the tube and it also feeds the field of the loudspeaker. This device marked "Ever Ready" is a C battery. With an amplifier such as you see here, it is necessary to impress upon the grid of the tube a negative C bias. In this particular case when we are using 180 volts on the plate of the tubes it is necessary to bias the grid with 40 volts of minus C battery. The battery that is in the rear of this one is in series with the first one to give the 40 volts. The first battery gives 22½ volts and the second battery gives 18½. This little double-throw switch is a switch to throw from the first stage to the second stage. It is marked "1" and on this side two. The last transformer on the board is what is known as the output transformer of the audio-frequency amplifier. It takes the output from the plates of the tubes and by transformation reduces them to suitable current [316] for reproducing. There is a storage battery to feed the filament of the tubes and the field of the speaker. It is just an ordinary storage battery; 6-volt storage battery.

Following a discussion between court and counsel, Mr. Pridham was asked by Mr. Loftus to identify a certain drawing, as follows:

Q. State whether or not that is a correct drawing of the apparatus that you have demonstrated in respect to the electrical connections.

A. This is a correct drawing of the two-stage amplifier as used with this exception, there is a

(Testimony of Edwin S. Pridham.)

small switch here which we did not use at all. It throws it from the first stage to the second stage. That is not shown on the drawing because it was not used at all. This happens to be a two-stage amplifier which was made by my small son for his radio set, and he used many contrivances on it, but I simply used it to amplify the pick-up from the phonograph.

Q. Was that drawing made under your supervision?

A. It was, and I checked it afterwards.

Mr. LOFTUS: I offer in evidence the drawing identified by the witness.

The COURT: Admitted.

(Drawing of electrical connections used in demonstration marked Plaintiff's Exhibit 26).

In answer to your question, the apparatus which is shown in the model and illustrated in the drawing Ex. 26 is not necessary to correct reproduction of the sounds. This particular apparatus is used for amplifying phonograph records. Any output of sufficient power such as a radio output or telephonograph output would operate these fixtures. It is necessary for this [317] particular demonstration to use a 2-stage amplifier. None of this intermediate mechanism is shown in the Pridham and Jensen patent. The dimensions of this enlarged pot are practically for the bottom part 10 inches in diameter and the top is about 4½ inches in diameter. It is roughly a 3-to-1 enlargement of the small sound-

(Testimony of Edwin S. Pridham.)

box. We did not put on the market any devices like Ex. 24. Exhibit 23 is a correct representation of the Magnavox loudspeaker. I used this big baffle board during my demonstration. It is 2 feet by 2 feet. The object of using this was to show the effect of restricting the front waves from interfering with the rear waves which are propagated by the diaphragm and made the machine work better than it did. There is no such baffle board shown in our patent.

(Thereupon defendants offered in evidence a board 2 feet x 2 feet with a hole in the center, as Defs'. Ex. LL. Also a similar board with a larger hole in the center, as Defs'. Ex. MM, both of which boards had been used by the witness during the demonstration.) Referring to Exhibit 25, the bottom part is about 10 or 10½ inches, maybe 11 inches, in diameter, and the ferrule part is approximately 4 to 4½ inches in diameter. The whole thing is supposed to be an enlargement of about 3 or 3½ to 1. The diaphragm of Exhibit 24 is a paper diaphragm, just pressed paper. There is no paper diaphragm shown in our patent. As for comparative dimensions of this Exhibit 24 as compared with the diaphragm shown in our patent, there is no dimension shown in the patent. We made them of all diameters. Exhibit 24 as compared with Exhibit 23 in so far as the diaphragm is concerned, is about three times larger. [318]

ERNEST INGOLD,

called as a witness by plaintiff.

Direct Examination by Mr. Loftus:

I live in Burlingame. I was formerly a distributor for Atwater Kent. I am a defendant in this case. I can not identify any of these instruments such as Plff's Ex. 4. I was subpoenaed at ten minutes after ten this morning and I have not seen my attorneys, I guess, for two months. I would like to talk with either Mr. Miller or Mr. Boyken. May I not have that privilege?

The COURT: Oh yes, you can talk to them. We will take a recess for five minutes.

(After recess): I paid Mr. Miller all of his bills to date with my funds.

Q. You were reimbursed by Atwater Kent?

A. No, not in cash.

Q. Answer the question?

A. I was given from time to time on my request, allowances by Atwater Kent at least partially to offset those checks.

Q. You say partially. Weren't you reimbursed entirely?

A. In the end it will figure out almost in its entirety.

Q. You had nothing to do with the conduct of the defense, did you?

A. Mr. Miller takes care of that.

Q. And Mr. Miller was selected by people in the East, that is the Atwater Kent Company?

(Testimony of Ernest Ingold.)

A. Mr. Miller was selected by me.

Q. What voice have you had in the conduct of this defense?

A. Well, Mr. Miller takes care of that; he is my attorney. I have no special voice in it. I severed my connection with Atwater Kent Company December 31st of last year, and I am no longer a distributor for Atwater Kent goods. [319]

HERBERT E. METCALF,

called as a witness for plaintiff.

Direct Examination by Mr. Loftus:

I am 39 years old and live at Walnut Creek, California. I became interested in radio in 1908; in 1912 being a member of Tufts College Wireless Society at Medford Hillside, Massachusetts; I went through and took a first grade commercial radio operator's license at Boston Navy Yard in June, 1912. From then on I have been actively interested and engaged in radio work. At Tufts College in 1913 and '14 we tested practically all types of telephone receivers which were then being made in this country. After graduating from Tufts College in 1914 I did post graduate work at the University of Illinois, at the University of Minnesota, and in 1917 was instructor at the North Dakota Agricultural College. I enlisted in the United

(Testimony of Herbert E. Metcalf.)

States Army in February 1918, was immediately sent to Columbia University and was commissioned in June and stationed as instructor in the Air Service School for radio officers at Columbia University. I had courses there in vacuum tubes under Professor Morecroft, and in alternating current under Professor Schlichter. I was sent from Columbia University to Bolling Field as radio officer in charge of radio development work for the United States air service, working directly under the director of air service. From there I was sent to California and had charge of the aeroplane radio for the United States Forest Patrol and for the Border Patrol in 1919. I resigned from the Army after having received a commission as second lieutenant in the regular army, to enter the employ of the Magnavox Company in October, 1920. I stayed with the Magnavox Company until 1928, and resigned as chief engineer to enter consulting work. After doing consulting work in a number of allied lines I spent the last two and a half years doing development work in sound recording and sound reproduction. I have just returned from seven [320] months in Hollywood, which I spent at the studios of Warner Brothers, Fox and M. G. M.

My work at Hollywood was in connection with sound recording and reproduction for talking pictures. I am familiar with the Pridham and Jensen patents here in suit and was with them very close

(Testimony of Herbert E. Metcalf.)

to the time these patents were applied for. These devices were known as "dynamic" speakers.

Q. What was the first dynamic speaker of any sort that ever came to your attention?

A. When I was at Bolling Field, any equipment which had to do with radio that had been brought to the attention of the air service was brought to Bolling Field to my laboratory for test. Mr. Pridham, and I think Mr. Steers, who at that time was president of the Magnavox Company, brought out to the field a number of dynamic speakers and a two-stage amplifier. We set up these speakers on Bolling Field and made a number of tests where some of our men walked over the field to a distance of two and three miles listening to music and speech as it came from the speakers. On the basis of that demonstration I recommended that these speakers be used in the opening, I believe, of the Fifth Victory loan which took place—— Let me refer to my note book here—— April 21, I believe.

Q. What year?

A. April 21, 1919. In that demonstration a radio receiving set was installed on the steps of the Treasury Building and connected to a battery of speakers, at least with several Magnavox speakers, and after the set up had been made I was taken back to Bolling Field by a Government automobile, got in a plane which was equipped with a radio transmitting set, and flew over the Treasury Building at a height of approximately 2600 feet and read

(Testimony of Herbert E. Metcalf.)

into the microphone of the radio telephone the President's cable which had not been released to the press or the [321] public until that reading. That was caught on the Treasury steps by the receiving set and reproduced to the large assembled crowd as I was reading it. To the best of my knowledge the air service, or airplanes had not engaged in such communication before that time.

Q. Do you have any records or articles of descriptive nature bearing on these early tests?

A. During the time I was in the Army, due to the wish to keep track of things, and also to keep my releases in order, I kept a scrap book, and in that scrap book I pasted at that time clippings from newspapers which appeared in the press on the days following this demonstration.

Q. You have copies of those there have you?

A. I have both the original in the note book and photostats which were taken from it.

(Photostats of various nevspaper and scientific articles produced by the witness were offered in evidence, to which defendant objected as immaterial, irrelevant and incompetent and as hearsay. Objection overruled and exception allowed. Thereupon the photostats of various newspapers and scientific articles referred to by the witness were marked in evidence as Plff's Ex. 27).

Mr. LOFTUS: Q. Now from your experience in connection with loud speakers of the dynamic

(Testimony of Herbert E. Metcalf.)

type, what would you say are the essentials for a successful commercial loudspeaker?

A. Of course the first essential is that it shall be efficient. It should have mechanical efficiency, acoustical efficiency, and also electrical efficiency. If those are not combined the result will not be satisfactory as far as the sale is concerned to a consumer. It is quite possible to do away with efficiency, for instance, such as electrical efficiency in the laboratory where a large [322] amount of power is easily available, but for a commercial instrument which is acceptable to the public, efficiency right straight through is greatly to be desired.

Q. And that consists of electrical, magnetic and acoustical efficiency?

A. Yes.

Q. And mechanical?

A. And mechanical efficiency.

Q. You are familiar with the prior art that has been referred to here?

A. Yes.

Q. Just turn to that chart that has been offered in evidence as Plff's Ex. 16 and state whether or not that correctly sets forth the underlying principles of the various prior art structures as compared with the patent in suit.

A. That seems to very properly show the prior art, and also to show the present type of loudspeaker which is involved in the present case.

(Testimony of Herbert E. Metcalf.)

Q. Referring to the Lodge illustrations there, wherein are they lacking in respect to successful commercial devices.

A. One of the necessary things for a commercial device to have is portability, something which can be shipped, and the Lodge device is an assembled procedure. The flat sounding board D is resting lightly on the support, which we are given to understand are chemical retort stands, and one very interesting thing which I think can be proven very quickly is that unless the diaphragm there, or the sound board, is screwed down it will creep, the jiggling would creep it off the support and the coil would rub in the air gap and it would in no way be commercial.

Q. That is referring to the first figure on the chart marked Plff's Ex. 16?

A. Yes, in the upper left-hand corner.

Q. And in respect to the next one of the Lodge syntonic receivers, what have you to say in that regard?

A. A syntonic receiver might be compared, perhaps, to an automobile horn where [323] it makes a noise of constant frequency. Now the mere fact that a device such as Lodge states in his first type of device, that when it was loaded with a moving coil it became useless for a syntonic receiver, does not in any way mean that it became a wonderful loud speaker. The chances are a thousand to one, if it became useless as a syntonic receiver, it became ab-

(Testimony of Herbert E. Metcalf.)

solutely worthless as a reproducer of all frequencies. Now one of the surest ways to ruin the reproduction from any polytonic receiver, as you might call it, would be to load it, to dampen it, and if the addition of this coil made it so dampened that it would not act as a syntonic receiver, I can not see how in the world it would make it so that it would respond to all frequencies.

Q. Now in regard to the matter of supporting the diaphragm in the Lodge syntonic receiver, what have you to say?

A. There was no peripheral support and no diaphragm housing or sound box.

Q. Now directing your attention to the Johnson patent No. 1,075,786?

A. That Johnsen patent is a puzzle if you read it carefully, because in it he states that magnetic material is to be put on the moving coil. First and foremost, any magnetic material on a moving coil of that type would lock and stick that moving coil to the casing so hard that it could not move. In the second place, there is no peripheral support for the diaphragm and I can not see how you would get anything other than a pumping back and forth of that diaphragm D, and I can not see how you would get any sound out of it at all.

Q. In regard to Pollak, U. S. 939,625?

A. Pollak shows a double-ended device with an air gap in each end. In the air gap are moving coils to which are attached what presumably might be taken as a diaphragm. It is impossible to tell

(Testimony of Herbert E. Metcalf.)

from the patent whether those diaphragms move in phase or whether they move out of [324] phase, and it appears that the coils are held in the gap by two strips which pass over the face of the top plate, and if that is so, the coils would not be able to move except in one direction; they would be held from going in toward the center of the device because of the strips; they could not go both ways from zero. There is nothing which indicates the sound box or anything of that sort.

Q. In other words, it would not be a loudspeaker at all, would it?

A. No. As I remember it, those things that look like diaphragms were portions of a telephone transmitter.

Q. Now in regard to the Oliver U. S. Patent 951,695?

A. The whole secret of a loudspeaker is a device which can give a substantial motion to a diaphragm. Oliver shows a diaphragm and sound box, the diaphragm having the main moving coil placed away out near the periphery, and it would be impossible for a device of that sort to operate with any wide amplitude. In addition it has no means for spacing pole pieces, and if a device of that sort were shipped, the weight of the coil would undoubtedly fall on the central pole piece and drive it out of position. That was one of the things which often occurred.

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(Testimony of Herbert E. Metcalf.)

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Q. Now directing your attention to the illustra-

(Testimony of Herbert E. Metcalf.)

tion of the Magnavox loudspeaker, will you state whether or not the various objections that you have just mentioned are taken care of there in any way?

A. Yes.

Q. If so, how?

A. In the first place, the Magnavox speaker has good electrical efficiency. The air gap is small. The watt pounds of wire involved will be low because of the magnetic efficiency. The moving coil is set in there with a minimum of clearance. Now a minimum of clearance simply means that the air gap can be brought right up to the edges of the coil, the [325] sides of the air gap can be brought up to the edges of the coil, and if there is not anything to keep that coil from wobbling sideways it is impossible to keep the coil in such close relationship, and consequently it is necessary to keep three things in concentric relation, not only to put them there but to keep them there; the central pole piece B, the hole in the top plate A, and the moving coil must be made solidly, kept by some means or other from moving sideways; if you do that, then the air gap can be made very narrow and motion up and down to the extent of one sixteenth to one quarter of an inch can be had without danger of rubbing, and H spaces that pole, that center pole piece, and keeps it in concentric relation, and the solid relationship of the spider which fastens the moving coil on the diaphragm, keeps the coil in the field at all times. It has all forms of efficiency, it has acoustical effi-

(Testimony of Herbert E. Metcalf.)

ciency, it has a diaphragm which is corrugated, which is free to move up and down. As I remember it, the Magnavox metal diaphragms, such as have been show in evidence here, were several thousandths thinner at their edges than they were in the center, to free up the motion. It was well known even when I first came to the Magnavox Company, that a diaphragm should be free to move. As a matter of fact when I was in the laboratory there I made a large number of diaphragms of various kinds and various sizes and helped to test them out. I remember particularly one device which was made, and I think it was probably made before I came there, at least I saw it around 1920, which had the whole thing enlarged, both the field, the diaphragm, the sound box and everything.

Q. Prior to the time that you became acquainted with this Magnavox structure what was there available in the way of loudspeakers?

A. I had a problem on my hands at Columbia University as instructor in the air service school there, of instructing a large number of [326] students in code reception. I built a receiving set which we were allowed to have at that time, tuned to German and French stations. We received those in the office. I tried through the director of air service and through the agencies that I could, to get hold of a loudspeaker. I finally succeeded in getting an annunciator, a horn type speaker which was made by the Western Electric Company; it was the best,

(Testimony of Herbert E. Metcalf.)

and as far as I could find out, the only thing available at that time. It was a magnetic type of speaker, and if we tried to crowd it, to put any amount of energy in it, to make it talk up loudly, it would rattle, the armature would hit the pole piece, and it was not satisfactory and we did not meet with any satisfactory loudspeaker until we found a Magnavox dynamic at Bolling Field in 1919.

Q. To what extent, if you know, are the magnetic type of speakers manufactured and sold today in comparison with the dynamic type?

A. There is no comparison at all; as far as I know, the magnetic type, except for distress stock which has remained in junk shops for years, I don't know of any magnetic speakers, at least, which are being actually sold today.

Q. In regard to the use of a horn as compared with the large conical diaphragm, what is the similarity or difference in actual performance, according to your experience?

A. From actual performance point of view, for the finest and most faithful sound reproduction, there is no doubt whatsoever in my mind that the horn type of speaker is probably the best. My reasons for saying that are simply, from an examination of the industry which has developed in Hollywood for the recording and reproduction of talking motion pictures, while it is true that the General Electric Company has supported the cone diaphragm type or baffle type of speaker the Western Electric

(Testimony of Herbert E. Metcalf.)

Company has supported the horn type speaker. Many of the present day dynamic speakers as made by the Western Electric [327] Company, are used with a horn having conical diaphragms in them. The conical diaphragm is old, and has been well exemplified by Mr. Brown in some of the early receivers. However, in the mixer booth in the recording studios at Warner Brothers and at Fox's, and at M.G.M., they have gone to the trouble of putting in a horn with a four-foot opening; the horn itself is nearly as big as the mixer booth and is put on top of it, with the opening facing down; it is the funniest looking thing you ever saw; it is nearly as big as the booth. I asked them why they did not use the small inconspicuous easily-installed cone diaphragm for the speaker in this mixer booth, and they said they were not as faithful as the type which they were using then. Now that was not because they could not get them. Warner Brothers, M.G.M. and Fox, all of those studios might, if they desired to, use an instrument which could be bought on the open market for use in the studio, for even though they are operating under a Western Electric license, they are entitled to buy other instruments if they desire to. Where they do not need the very finest quality and where space is at an absolute premium, they do use the cone diaphragm type, the cone diaphragm and the baffle. One of these uses is in the projection room of a theatre; where all that is desired is to check the conversation, to see whether

(Testimony of Herbert E. Metcalf.)

or not it is being projected through to the horn. On the stage they will use a battery of horns behind the screen on the stage of the theatre, and a little cone speaker in the projection room to check by.

Q. Referring to the conical diaphragm, is that complete without a baffle?

A. If the conical diaphragm itself is large enough to act as its own baffle, it is complete without a baffle. Now the Western Electric Company had on the market for a long time what they called their 36-inch cone, a great big thing. Now the conical sides [328] of that device acted two ways. It vibrated in the center and acted as a baffle on the outside. But the devices of four or five or six inches in diameter will not function faithfully without a baffle and are not so used. The cabinets in which they are installed are the equivalent and do exactly the same thing as baffles. As to these baffle boards shown here, it is not necessary to make them run straight out. What is desired is to have a path interrupter between the front side of the diaphragm and the back side of the diaphragm of a certain limit, and that limit in size is determined by the low notes which you desire to reproduce. Now some people like high pitched sounds and some like low pitched sounds; if you want to adjust that you do it by the size of the baffle used.

Q. Compare the operation of the baffle with the horn.

A. In the final analysis, what you have to do to

(Testimony of Herbert E. Metcalf.)

make sound waves is to take the electrical energy and transform it into mechanical energy which creates sound waves. Now in order to do that we have to cause motion some way or the other. Then we have to cause that motion to put the air in motion one way or another. Whether we choose to do it through a small diaphragm, which does not need to be of any particular shape, and then put a horn associated with that to gradually build up a grip on the air and free surface, or whether we put a baffle around there to prevent the waves from one side of the diaphragm going around to the back of the diaphragm and neutralizing themselves, does not make any difference. It is a question of the load. In order to get a propeller to operate efficiently in water you have got to have some kind of a load transmitted to that propeller. If we have a small propeller hitched onto a great big boat, we know in order to move that great big boat we ought to put on a big propeller, or we could put on the little propeller and move it very fast. [329]

Now as a typical example, the "Miss England", which is the fastest boat today, uses small propellers but runs them at 12,000 revolutions per minute; it does not make any difference—you can use a large diaphragm where it gets its grip directly on the air, or you can use a small diaphragm and bring out that air which is put in motion by the diaphragm to the opening of a horn to get its grip at the opening.

(Testimony of Herbert E. Metcalf.)

As a matter of fact, in these big theatres, such as the Fox Theatre up here, it would be impossible to set enough air in motion with the cone type of diaphragm alone; they could not do it; they would have to use twenty or thirty cones to set enough air in motion, but if they put one of these same cones, or as probably better designed by the Western Electric Company, a diaphragm and sound box, in back of a horn which has an opening, we will say six feet across, then with that big six-foot opening air could be set in motion, to fill the theatre with sound.

Q. Now in regard to a sound-box, what is your understanding of the meaning of that term in the art?

A. Dayton C. Miller calls it a diaphragm, and a diaphragm housing. Now it seems quite significant to me that the word "housing" was used by Dayton C. Miller away back in 1916. He called it a diaphragm housing; with these cones they call them cone housings. The diaphragm in its housing was what we knew in 1920, 1921, 1922, 1923, along in there, as a sound-box, and Dayton C. Miller, in his designs, showed them with the front wide open, with the back wide open, and we knew at the time that the sound-box could be made open, closed, or any old way. I simply took it for granted that in any sound box the diaphragm naturally was supported at its edges; I have not known of any sound box, which I would call a sound-box, where the

(Testimony of Herbert E. Metcalf.)

diaphragms were not supported at their edges, [330] and consequently I took it purely for granted and did not so state.

Q. The importance of that support at the edge of the periphery is what?

A. It is very important because of the phenomenon which is known as blasting, and which causes certain areas of the diaphragm to flutter (I call it flutter, I do not like to call it vibrate, because they do not go through any regular motion). I think a good example of blasting or fluttering is such as when you take a piece of paper by its edges and shake it. There are nodes gathered at points and these cause a tremendous fluttering, and that fluttering can be heard; if you leave any of the edges exposed, that particular part of the edge will do that.

Q. You have seen the chart which has been offered in evidence as Plff's Ex. 12, have you?

A. Yes.

Q. Did you have anything to do with the preparation of that?

A. I did.

Q. Is that scientifically correct?

A. I have seen devices which illustrate each one of these sketches which are shown here. There is nothing there which I have not seen in use. I might say as regards Lumiere, Patent No. 1,036,529 up in the upper left-hand corner, I have never happened to use one like that, with the little bell-shaped flare on it, but I have seen a device which has been en-

(Testimony of Herbert E. Metcalf.)

tered as an exhibit here of that type, and I also saw the old Victor speaker which was made with a diaphragm of that kind. Down in the lower left-hand corner, I have seen a number of installations of that kind where the cone diaphragm speaker was placed in the end of a horn, for the simple reason, as I said a few moments ago, the cone diaphragm alone with its baffle, for instance, will not be a sufficient load for the cone to get a large amount of energy into the air, so they load it some more by putting a horn on it. There are a number of advertising [331] trucks running around which have cones mounted in the end of the horn.

Q. Directing your attention to the first patent in suit, No. 1,266,988, what, if any, importance has the manner of arranging the lead-out wires as shown therein?

A. When this device was used as a loudspeaker, particularly when large amounts of power were put through it, the diaphragm moved over quite a wide range, and I have seen in the laboratory devices of this character in which the leads have been brought out in a number of different ways. I have seen the fine wire of the moving coil brought out directly. I have also seen the wires break under no more than a few seconds of operation under heavy signals, heavy input, and very often, most often, the fine wire of a moving coil was brought out to a point on the diaphragm and then it was soldered and attached to a strip or another wire, or anything

(Testimony of Herbert E. Metcalf.)

which had more strength and was more flexible than the lead wire. I have seen a number of different materials used for that purpose, not lately, but in the days when I first came with the company, from what I have been able to find out, such a device has become absolutely a necessity for dynamic speakers.

Q. In that connection I want you to refer to prior patents that have been offered here in evidence, including Edison No. 203,015, Rogers No. 297,168, Richards No. 521,220, Shreeve No. 602,174. State whether or not any such problem is encountered in any of these devices therein shown and described.

A. The Edison, No. 203,015, as far as I can see, is a microphone; it has no motion of its own. It is actuated by the voice impinging on the diaphragm and has no motion which would necessitate its [332] breaking its wire. Rogers is a telephone transmitter; Richards is a telephone transmitter. Shreeve is a telephone transmitter. I think that is all of them. They are telephone transmitters, and even though you got up close to them and spoke as loudly as you could, you could not move that diaphragm, I do not believe one tenth or even one hundredth, as far as the diaphragms of these dynamic speakers move. These speakers move, as has been stated, from one tenth to one eighth under full excitation and the strip of flexible material did not break.

Q. You have heard some discussion here as to articles and devices made by Rice & Kellogg. Are you familiar with those?

(Testimony of Herbert E. Metcalf.)

A. I am.

Q. Will you state in respect to date just where they bear any relationship to the Magnavox devices that you have been discussing?

A. In reference to the date, did you say?

Q. Yes.

A. Well as far as I know, the Rice & Kellog disclosure came after the devices which you have been discussing were made in the laboratory by the Magnavox Company.

Q. That is the conical diaphragm?

A. Yes; we were working in the laboratory on many types of diaphragms long before we ever put anything on the market.

Q. That is the device that Mr. Miller referred to here as the Greaves application?

A. Yes.

Q. And those structures went back to when?

A. They went back to the early part of 1924, as I remember it.

Q. In other words, then, there was nothing in this Rice & Kellogg disclosure that was not already in the possession of Magnavox?

A. I would not say that, because if it had been, they would not have gotten any patent. There are certain features of their invention that were new to them, but the general idea of using a cone diaphragm in the way that they did use it did not disclose anything new to us. [333]

Q. You were an engineer there at the Magnavox

(Testimony of Herbert E. Metcalf.)

Company at that time?

A. Yes.

Q. And so far as the conical diaphragm was concerned, why did you not file an application for patent on that?

Mr. MILLER: Objected to as immaterial, irrelevant and incompetent.

The COURT: Overruled and exception.

A. Due to the fact that we had had, in our laboratories, cone diaphragms hitched to dynamic drives for a long time, and the fact that the cone diaphragms were old, and the type of drive did not seem to have anything particularly new about it, we did not even consider applying for a patent until it became quite evident that Rice & Kellogg, one or both, had been doing something along that line, and then of course it was up to us to be diligent, and if there was anything patentable, to protect our company.

Cross-Examination by Mr. Miller:

I was in the regular employ of The Magnavox Company from October, 1920, until February, 1928, and received a salary for my services. I had some stock in The Magnavox Company, but I do not own any stock in that company at the present time. I sold it shortly after I left their employ. My office now is at 57 Post St., San Francisco, where I am associated with a Mr. Lippincott, whose business is the soliciting of patents. I do not solicit patents. Mr. Lippincott was a former employee of The

(Testimony of Herbert E. Metcalf.)

Magnavox Company. As to the implement that I tested at Bolling Field, it was a dynamic speaker and it is my recollection that the apparatus was brought to the Field the first time sometime before April, 1921. To the best of my knowledge, both types of instruments were investigated at Bolling Field; that is, the flat coil and the round coil. There was a horn at- [334] tached to the implement. At Bolling Field we had a number of radio receiving sets and also a phonograph drive, and we played radio and we played the time-signals from Arlington. I remember we amplified and heard them across the Field. The only necessity for such apparatus was that I had been given orders to test out the devices under varying circumstances. The flat coil that I referred to is the one shown in Pridham and Jensen Patent 1,366,988, and the annular coil which I used is shown in Patent 1,448,279. We sent a man out to the extreme limit of the Field, over by the river (the Potomac River runs there; I imagine it is between 2 and 3 miles) and we talked through the microphone and he listened, and the sound came out of the mouth of the horn. In regard to the device which I used from the aeroplane, we had a standard aeroplane radio telephone transmitter and receiver which was supplied through the Air Service, through Government sources. We had a radio set that had both a transmitter and a receiver, so that we could send and receive from the plane. I talked into the microphone and on the

(Testimony of Herbert E. Metcalf.)

plane we had a radio telephone transmitter set which permitted us to broadcast exactly the same way as the modern KPO station up here, for instance, except that it was in the plane while the plane was flying. Down at the Treasury steps there was an antenna receiver and radio receiving set and amplifiers and a horn just like we have today. Transmission between the plane and the ground was by radio. We did make instruments where we put the horn in the plane; but that was not at this time.

Mechanical efficiency consists of parts of the device put together in such a way that the clearances, measurements and such are uniform and that they stay that way. That is a matter of design; skilled design and good workmanship combined. To get [335] this mechanical efficiency it must be at least such as taught by the Pridham and Jensen patent.

Q. The same applies to the cone construction, does it not; everything must be arranged in order and in proportion, and well built?

A. That is so.

Q. If that is the case, the cone diaphragm construction would be mechanically efficient, would it not?

A. It would if it was constructed in accordance with these teachings, the teachings of the Pridham and Jensen patent.

The cone device has not anything to do with the teachings but the method of supporting the center

(Testimony of Herbert E. Metcalf.)

pole piece certainly has. By the method of supporting the center pole piece I mean the spacing device. Spacing devices were not old in that connection. I do not see them in any of these prior patents. I do not see a spacing device in the patent of Sir Oliver Lodge applied to the pot-type of magnet. This figure in the little blue book which represents Fig. 5 in the Lodge printed patent does not show in yellow a spacing device. In the Milliken patent No. 262,811 there is a device which holds the two magnets in place. There is no other support for that, that I can see. Whether they act as a spacer or not I could not say. I have not read the patent.

The other thing which I said contributed to the efficiency of the machine was acoustical efficiency. This involves properly designed means for setting the air in vibration, soundbox and diaphragm. The soundbox and diaphragm would not make a better construction than the cone construction. It is all according to how you design the devices to go with it. As to what devices go with it, there would be a horn and a baffle; anything you want to use with it. The magnetic efficiency construction of the patent is a properly designed pot with a magnetic coil and minimum magnetic leakage and loss. I would consider a properly designed pot of this sort was where the air gap was as small as possible. Possibly the prior art shows narrow air gaps, but just because they show an air gap does not mean that they have magnetic efficiency. The Siemens Patent 4,685 un-

(Testimony of Herbert E. Metcalf.)

doubtedly shows a narrow air gap, but not a magnetizing system that I could call of great efficiency. So far as the air gap is concerned it looks [336] all right. That is not true of the patent to Milliken, 256,795. It does not look like a narrow air gap. There is a big air gap; a big space around the coil. The Pollak Patent 939,625 shows two air gaps. An air gap is a gap in the magnetic circuit, and there are two gaps in this magnetic circuit, and it is equivalent to one gap. They are in series. When you combine them together it is not a narrow air gap; it is a double reluctance. Pollak does show a rather narrow air gap. The art prior to the Pridham and Jensen patent shows narrow air gaps. In so far as the efficiency depends on a narrow air gap alone, these other devices would be considered efficient in that respect.

I am not now employed by The Magnavox Company. They asked me to testify for them. We have not had any discussion about payment for my time. I expect to get paid for my time. I have no regular fees because I do not do this regularly. I expect to get compensation.

By stipulation, depositions taken in prior litigation and consisting of the testimony of Stafford W. Warner, Bernard H. Linden, Harry I. Zemansky, and Chris Eiferle, respectively, were offered by plaintiff and considered as having been read in evidence, said depositions being as follows: [337]

(San Francisco, Oct. 11, 1929)

BERNARD H. LINDEN,

a witness on behalf of plaintiff.

Direct Examination by Mr. Loftus:

My residence is 906 San Jose Ave., Albany, California. My occupation is Supervisor of Radio, Sixth Radio District, Department of Commerce, U. S. Government. I have been supervisor since the death of Col. J. F. Dillon. Prior to that, as assistant radio inspector and as radio inspector in the same office since the early part of 1917. My experience in connection with telephony and radio began, I should say, in the year 1906 or 1907. More definitely, that is, I took a more active interest in 1909 than previously. From the time that I began to make my own living until the present date it has been my sole means of livelihood.

I cannot answer as to the exact date the first loudspeaker of a moving coil type came to my notice, but it was considerably before the year 1921. Pardon me, I would not say "considerably" in years, but some time before 1921. It was called a Magnavox loudspeaker of the dynamic type. At this time, when I first learned of the Magnavox dynamic speaker, there were no other loud speakers on the market that I knew of manufactured as such.

There was a need in the trade for a loudspeaker prior to the time when I first learned of the Magnavox.

When I first became acquainted with the Magnavox loudspeaker it was used as a public address sys-

(Deposition of Bernard H. Linden.)

tem, you might say. In fact, in the year 1921 it was used in connection with such a system. In the year 1921 I personally used it as such to amuse the crowds at the place of business where I was a partner. The Magnavox people were manufacturing such a system for use at that time, and we had on sale in our place of business, such apparatus. Then, of course, it was used extensively for radio. The name of the [338] partnership I was in was Warner & Linden, in the City of San Francisco. I may mention here that there was an interruption in my service with the Supervisor's Office for three months during the time that I opened that store down at 350 Market St. I think before in my testimony I mentioned that I had been associated with that office from 1917. I do not believe, though, that I said without a break. I think that was the only break that occurred.

The attention attracted to the trade at the time we introduced this Magnavox speaker is shown by this: Whenever it was operated at the store we could hardly move around the street on account of the crowd that would come in to listen. There was a great demand, obviously, for the speaker, inasmuch as there were no other speakers manufactured or for sale at that time.

We sold these Magnavox speakers to considerable extent. In fact, the other equipment that we could sell at that time was something that we had to assemble. We would take an old-type ear receiver

(Deposition of Bernard H. Linden.)

and bush it and put an old phonograph horn on it, which would not handle much volume; the Magnavox speaker was the only speaker manufactured that we sold.

Cross-Examination by Mr. Mueller:

By "public address system" I mean a loudspeaker system capable of amplifying the voice so that a multitude would be able to hear what the speaker had to say, and in this particular case that is speaking by telephonic connection from a transmitter to the loudspeaker, and not by radio. Broadcasting originated for home entertainment long before the advent of the vacuum tube. It was first accomplished through a medium of transmitters, and not the vacuum tube. Many were interested in receiving such demonstrations as were put on by Jack McCarthy, as we knew him in those days, and the Dwyer Wireless Telephone Company. Radio [339] broadcasting, such as we know it to-day, for home reception, increased in popularity, and became very popular around 1921 and 1922.

XQ. In 1921 what broadcast receivers were on the market?

A. In 1921 the receiver for home use that was in real demand, in fact it had such demand that local manufacturers were not able to supply the demand, was the Kennedy receiver. I think the Tom B. Kennedy organization amalgamated with the Wagner people, if I am not mistaken, and produced a

(Deposition of Bernard H. Linden.)

receiver together. Subsequently, I think it was discontinued, for some reason or other. I have an idea that Tom B. Kennedy is now manufacturing receivers again under his own name, but I cannot swear to that. I believe that is so. In 1921 I think the Sunnyvale Radio Shop was manufacturing a receiver of the regenerative type. I think also Ord was. Both of them were working under the Armstrong patents. The Sunnyvale Radio Shop had quite an establishment at Sunnyvale. In fact, they went under production there with a new factory, as I recall it. That may have been in the early part of 1922. I am not sure of the exact date. It may have been a little later when they went under production in the new factory at Sunnyvale. Tom Lambert was the engineer in charge. They went under production to such a great extent that through—well, I don't know, it may have been mismanagement or it may have been because of going into the business too extensively with not sufficient capital behind them, the firm I believe went bankrupt. I am not certain.

As to the power that was delivered by those two receivers, some of the receivers at that time, as I recall it, were manufactured with tuning units alone; that is, I mean the receiver proper, and without the detector tube or panel being an integral part of the receiver. Others were manufactured with the detector—I am [340] not certain whether any amplifiers were included in any of the receivers proper, but separate amplifiers were pro-

(Deposition of Bernard H. Linden.)

vided. I know that we sold a Magnavox power amplifier for the purpose of operating their power loudspeaker. At that time it was a Magnavox horn speaker that we sold. The horn type was the only type Magnavox speaker we sold. On those two broadcast receivers that were on the market in 1921 and 1922, there was sufficient power available from either of them to operate the Magnavox loudspeaker, but being of a power type it required for satisfactory operation and real volume a power amplifier such as was usually supplied. The speaker could be operated with the receiver, itself. You could hear it throughout the room. Naturally, a person would want a volume commensurate with the size of the room, and to get that volume he would add an amplifier to increase the volume. It could be incorporated in the same sets; in fact, sets were sold at the time with amplifiers incorporated. Composite sets of all sorts were built up and sold in those days; in 1921. I think, if I am not mistaken, that the Leo J. Meyberg people manufactured a receiver at that time with two stages of amplification included in the receiver itself. I cannot swear to the date, but I am quite sure it was at that time, in 1921 or 1922.

(San Francisco, Oct. 15, 1929)

Deposition of

STAFFORD W. WARNER

a witness on behalf of plaintiff.

Direct Examination by Mr. Loftus:

I am a co-partner in Warner Brothers, doing a retail business in San Francisco and Oakland, E. N. Warner and S. W. Warner are the co-partners. We have been doing a retail radio business since about 1920 in Oakland and San Francisco. I have been connected with radio, amateurishly, for about 20 years. I was a young fellow when I started to take up the study of telegraphy.

The first commercial loudspeaker of a moving coil type to come to my attention was the "Magnavox". It was also the first one that I had any connection with in retail sales or uses. I first heard of the Magnavox loudspeaker about 1920; that is, the R-2 and the R-3, I believe, if the numbers are right.

Prior to that time there was need for a loudspeaker. We would have liked to have had at that time something to make something audible to crowds. I was not very well up on the Magnavox equipment to do that, and so, therefore, we used just a Baldwin unit, as it was called, put out by the Nathaniel Baldwin Company of Salt Lake City. We took a lot of long papier mache horns from the Kohler & Chase Company; we made loudspeakers from them, using the Type C magnetic type units. They were the loudest speaking small unit that we

(Deposition of Stafford W. Warner.)

could get and put onto a horn to make it loud. We used many of them at that time, using them both for radio and speaking positions—speaking to small crowds out in places, and in different ways where we wanted to make ourselves heard.

This modified Baldwin device was just for small crowds I might say. We could not be heard very far. It was used with crowds very close to the instrument. We used it for ball games, [342] and things like that. It was not a very satisfactory device. The Magnavox Company put out the R-2 and R-3, I think it was R-2, which we used with an amplifier. We sold many of them about that time to start them off. People were much interested in them, and we sold many of them at that time. The Magnavox instrument was received very well by the trade and by the public. It seemed to be liked by them very much. They seemed to like it very well on account of its being plain and distinct. It did come out loud. Everything that was spoken into the microphone or amplifier was loud with it. We built up apparatus at times to make it louder. The Magnavox Company had a very satisfactory amplifier, but it was very expensive. Some of the amateurs liked to build their own amplifier to make the Magnavox still louder. The Magnavox would throw out these sounds to the crowds where it was used, such as down in front of the "Examiner" office, in speaking to the crowds on the street. We also had it at schools for gradu-

(Deposition of Stafford W. Warner.)

ation exercises. We had it over in Oakland at a traffic regulation show. They had some kind of an exhibit there and we used it at the Auditorium. Also at several more places where it was very satisfactorily received by the people.

We sold many thousands of dollars worth of these Magnavox Loudspeakers, the R-2 and the R-3. Our firm probably is one that has sold the most of them about the Bay. We had at one time orders in for as many as 500, and the Magnavox Company could not furnish them, could not furnish the stock fast enough for us. We used to have to use our own pick-up delivery and go to their places and get from them. We used to make several trips a day. As fast as they could manufacture them we would be given our pro rata order. We used up many speakers that way. Sometimes we had them delivered to our firm on trucks. We used probably many thousands of dollars [343] worth, sold them to retail customers in San Francisco and Oakland. That was probably from 1921 or 1922 up to 1924 or 1925. We seemed to have had a larger distribution at that time than a little bit after that, on account of the shape of the horn. It seemed to detract from the beauty of the instrument, and people were getting fed up on the shape of the horn. They wanted furniture. In our retail business we sort of had to drop out of it for the time being, the sale was getting smaller, and then we were getting into cabinet

(Deposition of Stafford W. Warner.)

work, more of the paper diaphragm type. I am not so well up on explaining any of the manufacturing points of the Magnavox. I am more interested in the sale of the Magnavox product. At that time we sold a big quantity at retail, both in San Francisco and Oakland.

Cross-Examination by Mr. Mueller:

We sell the Magnavox products at this time and have been selling Magnavox products since about 1920. We sold their horn type of speaker, the R-2 and R-3. I could not tell you much on the construction of the mechanism inside the base, although it was the movable coil type. I could not explain to you how the diaphragm and sound-box were constructed, because I am not technically acquainted with that. I am more on the retail end of selling merchandise in our store. [344]

TESTIMONY OF HARRY I. ZEMANSKY.

a witness for plaintiff in rebuttal.

Direct Examination by Mr. Loftus:

I am now and since 1913 have been engaged in the radio or electrical business. I originally started to work for a firm called the Pacific States Electrical Company, which eventually became a subsidiary of the General Electric Company; I worked for them from that time up to the war, when I

(Deposition of Harry I. Zemansky.)

enlisted and served in the Navy. Then I came back to work for them for a very short time, and then I went to work for a company called the Marine Electric Company, and worked for them for several years, and then I took charge of the Radio Department in the White House, a concession which I now own.

I am familiar with a loudspeaker known as the Magnavox Electrodynamic Loudspeaker. I first learned of that general type of instrument about 1919, mostly through the newspapers and different magazines that youngsters subscribe to interested in radio in an amateur way.

Q. Prior to that time was there any demand, so far as you know from your contact with the electrical business, for a loudspeaker?

A. The company I worked for was supplying ships with electrical equipment, and also repairing the electrical equipment on these ships, and at that time the operators were very much interested in the Magnavox and were using it themselves, in fact buying it for their own personal use to receive the signals. Prior to that time there was a station called KDN, located at the Fairmont Hotel, and they were broadcasting phonograph records, and they were using that to further their own entertainment.

Q. So that prior to 1919 or 1920 there was a demand for a loudspeaker?

A. Yes, I would say there was a demand. I

(Deposition of Harry I. Zemansky.)

can [345] recall an incident where we could have used one very nicely back in 1912. At that time, in the Presidential election, Wilson was the candidate, and they first announced his returns over the radio from station KDN; they were trying to reach a station in San Jose operated by Professor Herald. I can remember the folks calling in the neighbors to hear this. We would pass the earphones from one to the other. At that time we could have used a loudspeaker very nicely.

Q. To your knowledge was there any loudspeaker made commercially and sold prior to the time you first learned of the Magnavox?

A. There was a form of speaker that we made up, ourselves, which was sold. It was more or less of a magnetic earphone with a paper cone on it. You could set up any kind of earphones. Then there was the Baldwin. That was the only type of speaker we knew of at that time.

Q. That was the magnetic type?

A. That was the magnetic type.

Cross-Examination by Mr. Wilkinson:

My knowledge of radio has been acquired through my business connections here in San Francisco.

Q. Do you remember that as far back as 1915 loudspeakers were employed in auditoriums and grandstands of baseball parks?

A. I recall publicity to that effect, that there were loudspeakers used. I believe the Magnavox people gave a demonstration here about that time.

(Deposition of Harry I. Zemansky.)

Q. Before your knowledge of the Magnavox, did you know that other loudspeakers, such as the Automatic Electric Company's loudspeakers, were being installed in depots and hotels?

A. No, I did not.

TESTIMONY OF CHRIS EIFERLE,

a witness for plaintiff in rebuttal.

Direct Examination by Mr. Loftus:

I am at present engaged in the radio business. I started in in an amateur way in 1908, as an amateur wireless enthusiast. When I first became employed in radio was in the latter part of 1919. I was then employed by Warner Bros. in San Francisco.

I am familiar with the loudspeaker known as the Magnavox electrodynamic speaker. 1915 was really the first time I heard of a Magnavox dynamic loudspeaker. That was in connection with public address work in San Francisco, here, at the Auditorium, I believe it was, if I remember correctly. Then again later on in about 1920 the auditorium in Oakland was having a Public Food Show; at that time if one party spoke in one end you could not hear a sound at the other end on account of the acoustics of the building. Through a friend of mine they told me to see the head of the Auditorium and see if I could not get in some

(Deposition of Chris Eiferle.)

loudspeakers, or some equipment in there so that they could hear. So I got in touch with the Magnavox Company, which was located in Oakland at that time, and they loaned us all the equipment to put in the Auditorium, so that the addresses and such as that could be heard throughout the whole arena.

At that time there were no other loudspeakers being made commercially or being sold on the market. In fact, before I even was in the sale of radios there was a big demand for speakers. There were none on the market, at all, with the exception of the earphone type. The earphone type was not satisfactory, because it was not audible enough.

Q. And this demand has existed for how long, to your knowledge?

A. Being an amateur in wireless at that time, the Fairmont Hotel here in San Francisco, at the station KDN, was broadcasting [346] phonograph records, and also, as stated about the President's speech, I received the same thing at my home. Quite a number of amateurs did want loudspeakers. There were none at all to be had. Of course, the radio really did not start then. It was mostly all amateurs that really wanted the speakers. Not alone that, but the public, itself, needed something to broadcast sound or speeches over a great distance. There was nothing on the market, at all, outside the Magnavox. And that demand existed, apart from radio broadcasting.

(Deposition of Chris Eiferle.)

Cross-Examination by Mr. Wilkinson:

Q. Your knowledge of loudspeakers and radio has been acquired through your business here in San Francisco?

A. Yes, sir.

Q. Do you know what was the construction of the dynamic Magnavox loudspeaker that you heard in 1915?

A. No, I could not say.

Q. When was it that you realized that there was a demand here for a loudspeaker, not merely for radio, but for transmitting speeches, when was that?

A. The first real demand was, I should say, in 1919, by the San Francisco "Examiner", which had offices in Oakland. They wanted to announce the football games in Berkeley on Saturdays, but they had no way at all to make such announcements to the public except through a megaphone.

Q. That was in 1919?

A. I believe that was in 1919.

Q. You did not know that as far back as 1915 loudspeakers were being installed in auditoriums, and stations, and hotels, and the grandstands of ball parks, did you?

A. Not within my recollection, no. [347]

Thereafter Mr. Miller, on behalf of the defendants, offered in evidence copy of Patent 1,243,755, dated Oct. 23, 1917, issued to Naeser, et al. Objection on the ground that it had not been pleaded and was no part of the proof at this stage of the case.

Objection overruled and exception allowed. The patent was thereupon marked "Defs'. Ex. NN." [348]

IT IS HEREBY STIPULATED AND AGREED that the foregoing STATEMENT OF EVIDENCE is a correct copy of the condensed trial record, with the testimony stated in narrative form.

Dated: Aug. 23, 1933.

CHAS. E. TOWNSEND,
WM. A. LOFTUS
Attorneys for Plaintiff.
JOHN H. MILLER
A. W. BOYKEN,
Attorneys for Defendants Ernest Ingold, Inc., a corporation; and Stromberg-Carlson Telephone Manufacturing Company, a corporation, and Garnett Young & Co., a corporation.

The foregoing Statement of Evidence, consisting of 277 pages, is hereby approved.

Sept. 5, 1933 A. F. ST. SURE
U. S. District Judge.

[Endorsed]: Filed Sep 6 1933 [349]

[Title of Court and Cause No. 2615-S.]

NOTICE OF APPEAL.

TO DEFENDANT ABOVE NAMED, AND TO JOHN H. MILLER AND A. W. BOYKEN, ITS ATTORNEYS:

The above named plaintiff, The Magnavox Company, conceiving itself aggrieved by the final decree entered herein on or about April 1, 1933, dismissing the Bill of Complaint of the plaintiff herein, with costs and disbursements, hereby respectfully appeals from the said Decree to the United States Circuit Court of Appeals for the Ninth Circuit, for the reasons set forth in the Assignment of Errors filed herewith, and prays that a citation be issued as provided by law, to the above named defendant, ERNEST INGOLD, INC., a corporation, commanding it to appear before said Circuit Court of Appeals to do and receive what may appertain to justice to be done in the premises; that a transcript of the pleadings, proceedings, testimony, exhibits, and orders, together with a copy of the Opinion of this Court filed in this cause, on which said Decree was entered, duly authenticated by the Clerk of the Court, be transmitted to the United States Circuit Court of Appeals for the Ninth Circuit, under the rules in such cases made and provided.

THE MAGNAVOX COMPANY,
By Chas. E. Townsend
Wm. A. Loftus
Its Attorneys.

Dated: June , 1933.

Received a copy of the within NOTICE OF APPEAL this 29th day of June A. D., 1933.

MILLER & BOYKEN,
for defendant.

[Endorsed]: Filed Jun 30 1933 [350]

[Title of Court and Cause No. 2615-S.]

ASSIGNMENT OF ERRORS.

Now comes plaintiff herein, The Magnavox Company, and makes the following assignment of errors upon which it will rely upon its prosecution in the above-entitled cause of an appeal from the Final Decree made by this Honorable Court and entered herein on or about April 1, 1933.

I.

The Court erred in dismissing the Bill of Complaint.

II.

The Court erred in holding that Claim 8 of Patent 1,266,988 and Claim 8 of Patent 1,448,279 were not infringed by the structures of the defendant herein complained of.

III.

The Court erred in holding that said Claim 8 of Patent 1,266,988 and Claim 8 of Patent 1,448,279 must, on account of the state of the prior art, be so limited in their scope as not to be infringed by the devices complained of.

IV.

The Court erred in holding that plaintiff was not entitled to the relief prayed for in its Complaint or any part thereof.

V.

The Court erred in failing to find that said Patents 1,266,988 and 1,448,279, in respect to the claims in suit, were valid and entitled to a sufficiently broad range of equivalents as to be infringed by defendant's structures complained of.

VI.

The Court erred in failing to give due weight to the evidence showing that the patents in suit were the first in the art to disclose those features of construction which made [351] it possible to manufacture commercially and supply the public with a workable loud speaker of the moving coil or dynamic type.

VII.

The Court erred in failing to give due weight to the evidence showing that the combination of elements set forth in Claim 8 of each of said patents in suit accomplished new and useful results, to-wit, prevention of breakage of the fine wires extending from the moving coil to the stationary binding posts, in the case of Patent 1,266,988; and the positive and accurate spacing and centering of the inner and outer pole pieces and moving coil and the maintenance of the same under all working conditions, in the case of Patent 1,448,279.

VIII.

The Court erred in failing to give due weight to the evidence showing that a demand had long existed for a loud speaker of the moving coil or dynamic type, which had not been supplied by structures shown and described in prior art patents and publications; that the patents in suit in and by the combinations set forth in the claim sued upon, fulfilled a long-felt want, and that the structures of the patents in suit were instantly adopted by the public and extensively used.

IX.

The Court erred in not granting the injunction prayed for in the Bill of Complaint.

X.

The Court erred in not granting the costs, damages, and accounting prayed for in the Bill of Complaint. [352]

THE MAGNAVOX COMPANY,
Plaintiff,
By Chas. E. Townsend,
Wm. A. Loftus,
Its Attorneys.

Dated: June 29, 1933.

Received a copy of the within Assignment of Errors this 29th day of June A. D., 1933.

MILLER & BOYKEN
for defendant

[Endorsed]: Filed Jun 30, 1933 [353]

[Title of Court and Cause No. 2615-S.]

ORDER ALLOWING APPEAL AND FIXING APPEAL BOND.

Notice of Appeal and Assignment of Errors having been filed in this Court by the plaintiff herein, THE MAGNAVOX COMPANY, on or about the 30th day of June, 1933;

NOW, THEREFORE, IT IS ORDERED that the said appeal be and the same is hereby allowed; that the amount of plaintiff's bond on said appeal be and the same is hereby fixed in the sum of Five Hundred Dollars ($500.00), the same to act as supersedeas of the judgment for costs and disbursements heretofore entered against said plaintiff.

IT IS FURTHER ORDERED that upon the filing of such security a certified transcript of the record and proceedings herein, in accordance with the Statutes and Equity Rules, be forthwith transmitted to said United States Circuit Court of Appeals for the Ninth Circuit.

Dated June 30, 1933.

A. F. ST. SURE
United States District Judge.

[Endorsed]: Filed Jun 30 1933. [354]

[Title of Court and Cause No. 2615-S.]

APPEAL BOND.

KNOW ALL MEN BY THESE PRESENTS, that FIDELITY AND DEPOSIT COMPANY OF

MARYLAND, a corporation organized and existing under the laws of the State of Maryland and duly licensed to transact a surety business in the State of California, is held and firmly bound unto ERNEST INGOLD, INC., a corporation, defendant in the above-entitled suit, in the penal sum of Five Hundred Dollars ($500.00), lawful money of the United States, to be paid to said defendant, its successors, assigns, or legal representatives, for which payment, well and truly to be made, said FIDELITY AND DEPOSIT COMPANY OF MARYLAND binds itself, its successors and legal representatives, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that WHEREAS, the above named plaintiff, THE MAGNAVOX COMPANY, a corporation, has prosecuted an appeal to the United States Circuit Court of Appeals for the Ninth Circuit, to reverse the judgment of the District Court, Northern District of California, Southern Division, on or about April 1, 1933, dismissing plaintiff's Bill of Complaint with costs to defendant;

NOW, THEREFORE, the condition of this obligation is such that if the above named plaintiff, THE MAGNAVOX COMPANY, [355] shall prosecute its said appeal to effect and answer all costs if it fail to make its plea good, then the above obligation to be void; otherwise to remain in full force and virtue.

This recognizance shall be deemed and construed to contain the "express agreement" for summary

judgment, and execution thereon, mentioned in Rule 34 of the District Court.

FIDELITY AND DEPOSIT COMPANY
OF MARYLAND,

[Seal] By D. E. Gorton
Attorney in Fact

Attest: C. A. Bevans Agent

APPROVED this 30th day of June, 1933,
A. F. ST. SURE
U. S. District Judge.

State of California,
City and County of San Francisco.—ss.

On this 30th day of June, A. D. 1933, before me, Emily K. McCorry, a Notary Public in and for the City and County of San Francisco, residing therein, duly commissioned and sworn, personally appeared D. E. Gorton, Attorney-in-Fact, and C. A. Bevans, Agent, of the Fidelity and Deposit Company of Maryland, a corporation, known to me to be the persons who executed the within instrument on behalf of the corporation therein named and acknowledged to me that such corporation executed the same, and also known to me to be the persons whose names are subscribed to the within instrument as the Attorney-in-Fact and Agent respectively of said corporation, and they, and each of them, acknowledged to me that they subscribed the name of said Fidelity and Deposit Company of Maryland thereto as principal and their own names as Attorney-in-Fact and Agent respectively.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in the City and County of San Francisco the day and year first above written.

[Notarial] EMILY K. McCORRY
[Seal]

Notary Public in and for the City and County of San Francisco, State of California.

My Commission Expires January 16, 1935.

[Endorsed]: Filed Jun 30 1933 [356]

[Title of Court and Cause No. 2615-S.]

PRAECIPE FOR TRANSCRIPT OF RECORD ON APPEAL UNDER EQUITY RULE 75.

To the Clerk of the Above-Entitled Court:

Please prepare a Transcript of Record to the United States Circuit Court of Appeals, upon which the appeal heretofore taken by plaintiff from a final decree in the above-entitled cause shall be heard, including therein the following documents:

1. Bill of Complaint.
2. Minutes of Court allowing Motion to Quash Service against Atwater Kent Manufacturing Company;
3. Answer of Ernest Ingold, Inc.
4. Amendments to Answer.
5. Second Amendment to Answer of Defendant.
6. Order for Dedimus Potestatem.

7. Stipulation identifying Defendant's Loud Speaker and re Certain Depositions.

8. Memorandum and Order dated March 17, 1933.

9. Order Directing Dismissal of Bill of Complaint, March 18, 1933.

10. Findings of Fact and Conclusions of Law. [357]

11. Plaintiff's Objections and Exceptions to Defendant's Proposed Findings and Conclusions, and Plaintiff's Proposed Findings and Conclusions.

12. Minutes of Court, April 11, 1933, overruling Plaintiff's Exceptions to Defendant's Findings of Fact and Conclusions of Law.

13. Decree.

14. Notice of Appeal.

15. Assignment of Errors.

16. Order Allowing Appeal and Fixing Appeal Bond.

17. Citation on Appeal.

18. Appeal Bond.

19. Condensed Statement of Evidence.

20. Order Approving Narrative Statement of Evidence.

21. This Praecipe.

22. Certificate of Clerk.

23. The following Exhibits:

Plaintiff's Exhibit 1, Drawing;

Plaintiff's Exhibit 5, Patent 1,266,988;

Plaintiff's Exhibit 6, Patent 1,448,279;

Plaintiff's Exhibit 7, Photostat of page from book of Dayton C. Miller;

Plaintiff's Exhibit 12, Chart;

Plaintiff's Exhibit 16, Chart;

Plaintiff's Exhibit 18, Binder of Patents containing the following:

United States Patents to:

Maxwell	216,051	June 3, 1879
Dann and Lapp	338,660	Mar. 23, 1886
Duwelius	674,575	May 21, 1901
Shanks	822,024	May, 29, 1906
Lumiere	986,477	Mar. 14, 1911
Lumiere	1,036,529	Aug. 20, 1912
Johnson	1,180,401	Apr. 25, 1916

[358]

British Patent to Stroh, Number 3,393, of 1901.

Plaintiff's Exhibit 19, Chart;

Plaintiff's Exhibit 21, Chart of Magnavox Device;

Plaintiff's Exhibit 26, Drawing of Electrical Connections.

Defendant's Exhibit C, Bell Patent 186,787;

Defendant's Exhibit D, Siemens Patent 149,797;

Defendant's Exhibit E, British Patent to Siemens, No. 4,685;

Defendant's Exhibit F, Cuttriss and Redding Patent 242,816;

Defendant's Exhibit G, Cuttriss and Milliken Patent 256,795;

Defendant's Exhibit H, Milliken Patent 262,811;

Defendant's Exhibit I, Mather Patent 387,310;

Defendant's Exhibit J, Lodge (British) Patent 9,712;

Defendant's Exhibit K, Pages from "The Electrician";

Defendant's Exhibit N, Pages from "The Electrical Engineer";

Defendant's Exhibit O, Pearson Patent 903,745;

Defendant's Exhibit P, Pollak Patent 939,625;

Defendant's Exhibit Q, Oliver (French) Patent 404,286;

Defendant's Exhibit R, British Patent to Oliver, No. 12,857;

Defendant's Exhibit S, Oliver Patent 951,695;

Defendant's Exhibit T, Johnsen Patent 1,075,786;

Defendant's Exhibit U, Hopkins Patent 1,271,529;

Defendant's Exhibit V, British Patent to Edison, No. 2,909;

Defendant's Exhibit W, Edison Patent 203,015;

Defendant's Exhibit X, Rogers Patent 297,168;

Defendant's Exhibit Y, Richards Patent 521,220;

Defendant's Exhibit AA, File Wrapper and Contents of Patent 1,448,279;

Defendant's Exhibit BB, File Wrapper and Contents of Patent 1,266,988;

Defendant's Exhibit CC, Kellogg Publication; [359]

Defendant's Exhibit DD, Comer Patent 1,137,186;

Defendant's Exhibit EE, British Patent to Farrand, No. 178,862;

Defendant's Exhibit FF, Drawing of R. C. A. 104 Speaker;

Defendant's Exhibit GG, Certified Copy of Interference between Greaves and Kellogg;

Defendant's Exhibit HH, Patents 1,051,113, 1,088,283, and 1,105,924, to Pridham and Jensen;

Defendant's Exhibit II, French Patent to Pollak, No. 393,241;

Defendant's Exhibit JJ, Pridham and Jensen Patent 1,329,928;

Defendant's Exhibit KK, Drawing of Johnson patent;

Defendant's Exhibit NN, Patent 1,243,755, to Naeser, et al.

24. Stipulation re Transmittal of Exhibits to Court of Appeals.

Dated, this 8th day of August, 1933.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff

Service of copy of the within Praecipe for Transcript of Record on Appeal Under Equity Rule 75, admitted this 8th day of August, A. D., 1933.

JOHN H. MILLER
for Defendant.

[Endorsed]: Filed Aug - 9 1933 [360]

[Title of Court and Cause No. 2615-S.]

STIPULATION AND ORDER RE TRANSMITTAL OF EXHIBITS TO CIRCUIT COURT OF APPEALS.

IT IS HEREBY STIPULATED AND AGREED by and between the parties hereto, that

all of the original exhibits shall be withdrawn from the files of the above entitled Court and of the Clerk thereof, and by said Clerk be transmitted to the United States Circuit Court of Appeals for the Ninth Circuit, as a part of said Record on Appeal; said original exhibits to be returned to the files of the above entitled Court upon the determination of said appeal by said Court of Appeals.

Dated this 8th day of August, 1933.

CHAS. E. TOWNSEND,
WM. A. LOFTUS
Attorneys for Plaintiff
JOHN H. MILLER
A. W. BOYKEN
Attorneys for Defendant

It is so ordered.

HAROLD LOUDERBACK
U. S. District Judge

[Endorsed]: Filed Aug 9 1933 [361]

[Title of Court and Cause No. 2616-S.]

NOTICE OF APPEAL.

To Defendants Above Named and to Their Attorneys:

The above named plaintiff, The Magnavox Company, conceiving itself aggrieved by the final decree entered herein on or about April 1, 1933, dismissing the Bill of Complaint of the plaintiff herein, with costs and disbursements, hereby re-

spectfully appeals from the said Decree to the United States Circuit Court of Appeals for the Ninth Circuit, for the reasons set forth in the Assignment of Errors filed herewith, and prays that a citation be issued as provided by law, to the above named defendants, STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation, and GARNETT YOUNG & CO., a corporation, commanding them to appear before said Circuit Court of Appeals to do and receive what may appertain to justice to be done in the premises; that a transcript of the pleadings, proceedings, testimony, exhibits, and orders, together with a copy of the Opinion of the Court filed in this cause, on which said Decree was entered, duly authenticated by the Clerk of the Court, be transmitted to the United States Circuit Court of Appeals for the Ninth Circuit, under the rules in such cases made and provided.

THE MAGNAVOX COMPANY,
By CHAS. E. TOWNSEND
WM. A. LOFTUS
Its Attorneys.

Dated: June , 1933.

Received a copy of the within NOTICE OF APPEAL admitted this 29th day of June A. D., 1933.

MILLER & BOYKEN
for defendant.

[Endorsed]: Filed Jun 30 1933 [362]

[Title of Court and Cause No. 2616-S.]

ASSIGNMENT OF ERRORS.

Now comes plaintiff herein, The Magnavox Company, and makes the following assignment of errors upon which it will rely upon its prosecution in the above-entitled cause of an appeal from the Final Decree made by this Honorable Court and entered herein on or about April 1, 1933.

I.

The Court erred in dismissing the Bill of Complaint.

II.

The Court erred in holding that Claim 8 of of Patent 1,266,988 and Claim 8 of Patent 1,448,279 were not infringed by the structures of the defendants herein complained of.

III.

The Court erred in holding that said Claim 8 of Patent 1,266,988 and Claim 8 of Patent 1,448,279 must, on account of the state of the prior art, be so limited in their scope as not to be infringed by the devices complained of.

IV.

The Court erred in holding that plaintiff was not entitled to the relief prayed for in its Complaint or any part thereof.

V.

The Court erred in failing to find that said Patents 1,266,988 and 1,448,279, in respect to the claims

in suit, were valid and entitled to a sufficiently broad range of equivalents as to be infringed by defendants' structures complained of.

VI.

The Court erred in failing to give due weight to the [363] evidence showing that the patents in suit were the first in the art to disclose those features of construction which made it possible to manufacture commercially and supply the public with a workable loud speaker of the moving coil or dynamic type.

VII.

The Court erred in failing to give due weight to the evidence showing that the combination of elements set forth in Claim 8 of each of said patents in suit accomplished new and useful results, to-wit, prevention of breakage of the fine wires extending from the moving coil to the stationary binding posts, in the case of Patent 1,266,988; and the positive and accurate spacing and centering of the inner and outer pole pieces and moving coil and the maintenance of the same under all working conditions, in the case of Patent 1,448,279.

VIII.

The Court erred in failing to give due weight to the evidence showing that a demand had long existed for a loud speaker of the moving coil or dynamic type, which had not been supplied by structures shown and described in prior art patents

and publications; that the patents in suit in and by the combinations set forth in the claims sued upon, fulfilled a long-felt want, and that the structures of the patents in suit were instantly adopted by the public and extensively used.

IX.

The Court erred in not granting the injunction prayed for in the Bill of Complaint.

X.

The Court erred in not granting the costs, damages, [364] and accounting prayed for in the Bill of Complaint.

THE MAGNAVOX COMPANY,
Plaintiff,
By CHAS. E. TOWNSEND
WM. A. LOFTUS
Its Attorneys.

Dated: June. , 1933.

Received a copy of the within ASSIGNMENT OF ERRORS this 29th day of June A. D., 1933.

MILLER & BOYKEN
for defendant.

[Endorsed]: Filed Jun 30 1933. [365]

[Title of Court and Cause No. 2616-S.]

ORDER ALLOWING APPEAL
AND FIXING APPEAL BOND.

Notice of Appeal and Assignment of Errors having been filed in this Court by the plaintiff herein, THE MAGNAVOX COMPANY, on or about the 30th day of June, 1933;

NOW, THEREFORE, IT IS ORDERED that the said appeal be and the same is hereby allowed; that the amount of plaintiff's bond on said appeal be and the same is hereby fixed in the sum of Five Hundred Dollars ($500.00), the same to act as supersedeas of the judgment for costs and disbursements heretofore entered against said plaintiff.

IT IS FURTHER ORDERED that upon the filing of such security a certified transcript of the record and proceedings herein, in accordance with the Statutes and Equity Rules, be forthwith transmitted to said United States Circuit Court of Appeals for the Ninth Circuit.

Dated June 30, 1933.

A. F. ST. SURE
United States District Judge.

[Endorsed]: Filed Jun 30 1933 [366]

[Title of Court and Cause No. 2616-S.]

APPEAL BOND.

KNOW ALL MEN BY THESE PRESENTS, that FIDELITY AND DEPOSIT COMPANY OF MARYLAND, a corporation organized and existing under the laws of the State of Maryland and duly licensed to transact a surety business in the State of California, is held and firmly bound unto STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation, and GARNETT YOUNG & CO., a corporation, defendants in the above-entitled suit, in the penal sum of Five Hundred Dollars ($500.00), lawful money of the United States, to be paid to said defendants, their successors, assigns, or legal representatives, for which payment, well and truly to be made, said FIDELITY AND DEPOSIT COMPANY OF MARYLAND binds itself, its successors and legal representatives, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that WHEREAS, the above named plaintiff, THE MAGNAVOX COMPANY, a corporation, has prosecuted an appeal to the United States Circuit Court of Appeals for the Ninth Circuit, to reverse the judgment of the District Court, Northern District of California, Southern Division, on or about April 1, 1933, dismissing plaintiff's Bill of Complaint with costs to defendants;

NOW, THEREFORE, the condition of this obligation is such that if the above-named plaintiff,

THE MAGNAVOX COMPANY, shall prosecute its said appeal to effect and answer all costs if it fail to make its plea good, then the above obligation to be void; otherwise to remain in full force and virtue.

This recognizance shall be deemed and construed to contain the "express agreement" for summary judgment, [367] and execution thereon, mentioned in Rule 34 of the District Court.

FIDELITY AND DEPOSIT COMPANY
OF MARYLAND

[Seal] By D. E. GORTON
Attorney in Fact

ATTEST: C. A. BEVANS Agent

APPROVED this 30th day of June, 1933.
A. F. ST. SURE
U. S. District Judge.

State of California
City and County of San Francisco.—ss.

On this 30th day of June, A. D. 1933, before me, Emily K. McCorry, a Notary Public in and for the City and County of San Francisco, residing therein, duly commissioned and sworn, personally appeared D. E. Gorton, Attorney-in-Fact, and C. A. Bevans, Agent, of the Fidelity and Deposit Company of Maryland, a corporation, known to me to be the persons who executed the within instrument on behalf of the corporation therein named and acknowledged to me that such corporation executed the same, and also known to me to be

the persons whose names are subscribed to the within instrument as the Attorney-in-Fact and Agent respectfively of said corporation, and they, and each of them, acknowledged to me that they subscribed the name of said Fidelity and Deposit Company of Maryland thereto as principal and their own names as Attorney-in-Fact and Agent respectively.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in the City and County of San Francisco the day and year first above written.

[Seal] EMILY K. McCORRY
Notary Public in and for the City and County of San Francisco, State of California.

My Commission expires January 16, 1935.

[Endorsed]: Filed Jun 30 1933 [368]

[Title of Court and Cause No. 2616-S.]

STIPULATION RESPECTING FORM OF RECORD ON APPEAL AND HEARING OF APPEAL.

WHEREAS, at the trial of this cause in the United States District Court, the same was consolidated with Equity Cause Number 2615-S, The Magnavox Company vs. Ernest Ingold, Inc., and was heard upon the same evidence and proofs;

NOW, THEREFORE, subject to the approval of the Court, IT IS HEREBY STIPULATED that the appeal herein shall be heard upon one and the same transcript of record as the appeal in said cause Number 2615-S; that said transcript of record shall include the pleadings in this cause, the orders, decrees, findings of fact and conclusions of law, and exceptions thereto, notice of appeal, assignment of errors, order allowing appeal, bond on appeal, and citation, on file herein as set forth in the Praecipe in this cause, and the same Statement of Evidence as referred to in the Praecipe in Cause Number 2615-S.

IT IS FURTHER STIPULATED that all original exhibits offered in evidence in this case may be withdrawn from the files of the above entitled Court and of the Clerk thereof, and by said Clerk be transmitted to the United States Circuit Court of Appeals for the Ninth Circuit, as a part of said Record on Appeal, said original exhibits to be returned to the files of this Court upon determination of said appeal by said Circuit Court of Appeals.

Dated this 8th day of August, 1933.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff.
JOHN H. MILLER
A. W. BOYKEN
Attorneys for Defendant. [369]

The foregoing Stipulation is hereby approved, and an Order to the same effect is hereby made.

HAROLD LOUDERBACK
U. S. District Judge.

Service of copy of the within admitted this 8th day of August A. D. 193.....

JOHN H. MILLER
for Appellee & Defendant.

[Endorsed]: Filed Aug. 9 1933 [370]

[Title of Court and Cause No. 2616-S.]

PRAECIPE FOR TRANSCRIPT OF RECORD ON APPEAL UNDER EQUITY RULE 75.

To the Clerk of the Above-Entitled Court:

Please prepare a Transcript of Record to the United States Circuit Court of Appeals, upon which the appeal heretofore taken by plaintiff from a final decree in the above-entitled cause shall be heard, including therein the following documents:

1. Bill of Complaint.
2. Answer.
3. Amendments to Answer.
4. Second Amendment to Answer.
5. Stipulation Identifying Defendants' Loud Speaker and re Certain Depositions;
6. Memorandum and Order dated March 17, 1933;
7. Order Directing Dismissal of Bill of Complaint, dated March 18, 1933;

8. Findings of Fact and Conclusions of Law.

9. Plaintiff's Objections and Exceptions to Defendants' Proposed Findings and Conclusions, and Plaintiff's Proposed Findings and Conclusions.

10. Minutes of Court, April 11, 1933, overruling Plaintiff's Exceptions to Defendants' Findings of Fact and Conclusions of Law.

11. Decree.

12. Notice of Appeal.

13. Assignment of Errors.

14 Order Allowing Appeal and Fixing Appeal Bond.

15. Citation on Appeal.

16. Appeal Bond. [371]

17. Stipulation re Form of Record on Appeal.

18. This Praecipe.

19. Certificate of the Clerk.

Dated, this 8th day of August, 1933.

CHAS. E. TOWNSEND
WM. A. LOFTUS
Attorneys for Plaintiff.

Service of copy of the within Praecipe for Transcript of Record on Appeal Under Equity Rule 75 admitted this 8 day of August, A. D., 1933.

JOHN N. MILLER
for Defendants.

[Endorsed]: Filed Aug 9 1933. [372]

In the Southern Division of the United States District Court for the Northern District of California.

I, WALTER B. MALING, Clerk of the United States District Court, for the Northern District of California, do hereby certify that the foregoing 372 pages, numbered from 1 to 372, inclusive, contain a full, true, and correct transcript of the records and proceedings in the cases of THE MAGNAVOX COMPANY, vs. ATWATER KENT MANUFACTURING COMPANY, et al., No. 2615-S and THE MAGNAVOX COMPANY, vs. STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, et al., No. 2616-S, as the same now remain on file and of record in my office.

I further certify that the cost of preparing and certifying the foregoing transcript of record on appeal is the sum of $76.95 and that the said amount has been paid to me by the Attorneys for the Appellant herein.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said District Court, this 12th day of September A. D. 1933.

[Seal] WALTER B. MALING, Clerk.
By J. P. Welsh
Deputy Clerk. [372½]

[Title of Court and Cause No. 2615-S.]

CITATION ON APPEAL.

United States of America.—ss.

The President of the United States to ERNEST INGOLD, INC., a corporation, GREETING:

YOU ARE HEREBY CITED and admonished to be and appear before the United States Circuit Court of Appeals for the Ninth Circuit, to be held in the City of San Francisco, State of California, thirty days from date hereof, pursuant to an appeal filed in the Clerk's Office of the District Court for the Northern District of California, Southern Division, wherein THE MAGNAVOX COMPANY is appellant and you are appellee, to show cause, if any there be, why the decree in said appeal mentioned should not be corrected and why speedy justice should not be done to the parties in that behalf.

Given under my hand at the State of California, in the District and Circuit above named, this 30th day of June, in the year of our Lord one thousand nine hundred and thirty-three, [373] and of the Independence of the United States the one hundred and fifty-seventh.

A. F. ST. SURE
United States District Judge.

[Endorsed]: Received a copy of the within Citation on Appeal this day of June A. D., 1933.

MILLER & BOYKEN
for Defendant.

[Endorsed]: Filed June 30, 1933. [374]

[Title of Court and Cause No. 2616-S.]

CITATION ON APPEAL.

United States of America.—ss.

The President of the United States to STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY, a corporation, and GARNETT YOUNG & CO., a corporation, GREETING:

YOU ARE HEREBY CITED and admonished to be and appear before the United States Circuit Court of Appeals for the Ninth Circuit, to be held in the City of San Francisco, State of California, thirty days from date hereof, pursuant to an appeal filed in the Clerk's Office of the District Court for the Northern District of California, Southern Division, wherein THE MAGNAVOX COMPANY is appellant and you are appellees, to show cause, if any there be, why the decree in said appeal mentioned should not be corrected and why speedy justice should not be done to the parties in that behalf.

Given under my hand at the State of California, in the District and Circuit above named, this 30th day of June, in the year of our Lord one thousand nine hundred and thirty-three, [375] and of the Independence of the United States the one hundred and fifty-seventh.

A. F. ST. SURE
United States District Judge.

[Endorsed]: Received a copy of the within Citation on Appeal this 30th day of June A. D., 1933.

MILLER & BOYKEN
for Defendants. [376]

Filed Jun. 30, 1933. Walter B. Maling, Clerk.

Filed Sep. 14, 1933. Paul P. O'Brien.

[Endorsed]: No. 7284. United States Circuit Court of Appeals for the Ninth Circuit. The Magnavox Company, a corporation, Appellant, vs. Ernest Ingold, Inc., a corporation, Appellee. The Magnavox Company, a corporation, Appellant, vs. Stromberg Carlson Telephone Manufacturing Company, a corporation, and Garnett Young & Co., a corporation, Appellee. Transcript of Record. Upon Appeals from the District Court of the United States for the Northern District of California, Southern Division.

Filed Sep. 14, 1933.

PAUL P. O'BRIEN,
Clerk of the United States Circuit Court of Appeals for the Ninth Circuit.

By Frank H. Schmid,
Deputy Clerk.